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LONGMAN DICTIONARY OF SCIENTIFIC USAGE

The Reprint Edition

LONGMAN GROUP LIMITED, HARLOW

RUSSKY YAZYK PUBLISHERS
MOSCOW
1989

ГОДМАН А., ПЕЙН ЕМФ

ТОЛКОВЫЙ СЛОВАРЬ АНГЛИЙСКОЙ НАУЧНОЙ ЛЕКСИКИ

Стереотипное издание

ЛОНГМАН ГРУП ЛИМИТЕД, ХАРЛОУ

МОСКВА
„РУССКИЙ ЯЗЫК"
1989

ББК 72
Г 59

Годман А, Пейн ЕМФ

А Толковый словарь английской научной лексики.—М.: Рус. яз., 1989—728 с.

Данный словарь — переиздание в СССР словаря, впервые выпущенного в 1979 г. английским издательством „Лонгман".

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Г $\frac{2200000000—238}{015(01)—89}$ 231—88 ББК 72+81.2Англ.—4

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ТОЛКОВЫЙ СЛОВАРЬ АНГЛИЙСКОЙ НАУЧНОЙ ЛЕКСИКИ

Редакция научно-технических словарей
на английском языке

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ИБ N° 4991

Подписано в печать 15.05.89. Формат 60x90/16. Бумага офсетная № 1. Гарнитура таймс. Печать офсетная (с готовых диапозитивов). Усл. печ. л. 45,5. Усл. кр.-отт. 45,5. Уч.-изд. л. 88,8. Тираж 40 000 экз. (II завод 20 001 — 40 000 экз.) Заказ № 1633. Цена 5 р. 90 к. Издательство „Русский язык" В/О „Совэкспорткнига" Государственного комитета СССР по делам издательств, полиграфии и книжной торговли. 103012 Москва, Старопанский пер., д. 1/5. Отпечатано с готовых диапозитивов в Тульской типографии „Союзполиграфпрома" Государственного комитета СССР по делам издательств, полиграфии и книжной торговли. 300600 Тула, проспект Ленина, 109. Изготовлено в ордена Трудового Красного Знамени Московской типографии № 7 „Искра революции" В/О „Совэкспорткнига" Государственного комитета СССР по делам издательств, полиграфии и книжной торговли. 121019 Москва, Аксаков пер., 13.

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About this dictionary

This is a reference book and practical aid for students studying science through English during their final years at secondary school and for those students using English in their first year at a University but whose education has been in a language other than English. The book will also be of use to those for whom English is not their first language, but are working in the scientific field and need access to English material. It will also be helpful to those teaching English to science students.

The contents of the book

All the entries in the book are arranged into sets of terms that are closely related in meaning or subject area. This allows an entry to be compared or contrasted with related entries to make the meaning of a term clearer. There are two main sections in the book. The first comprises over 1300 basic terms commonly used in all branches of science, and which have different, and usually more precise, meanings in scientific contexts than they have in general speech. Included in this section are 180 prefixes, suffixes and general affixes of use in understanding many scientific terms. The second section defines over 8500 technical terms from the fields of biology, chemistry and physics. The entries contain other information, besides the definition, which will be of assistance in the usage of the term. The terms for biology, chemistry and physics are not divided into three separate sections; instead the sets of terms are presented according to an overall framework of scientific principles, as can be seen in the list of *Contents*.

The *Contents* shows the arrangement of terms in different subject areas. Each area is indicated by a two letter code, and within such an area or set, the terms are numbered consecutively. The set codes are placed at the top of each page showing the numbers of the terms covered. An alphabetical index at the back of the book lists all the terms and their place in the book, and indicates the subject field of the term where relevant.

How to use this book

There are several ways of using this book.

1 *Finding the meaning of a term when reading*

a) Look for the term in the alphabetical index, pp. 615ff.

b) If there is more than one reference, choose the correct field, either biology (Bio.), chemistry (Ch.), or physics (Ph.), and if necessary, the correct word class, *e.g.* noun (*n.*), verb (*v.*), or adjective (*adj.*). Note the set code, *e.g.* **natural** is coded **AB025**.

c) Use the letters to find the set, and then the number to find the term's position in it.

d) Read the definition and any examples.

e) Look at the entries above and/or below in the set, as these will show differences in meaning useful in understanding the term.

2 *Using a term when writing*

a) Find the term, as explained above.

b) Study the use of the term in the examples.

c) Note any collocations and information about how the term should be used.

3 *Searching for an unknown term when writing*
This is best shown by example. Suppose the term **cluster** for a group of flowers on a stalk is known, but a term is needed for a group of flowers growing thickly on a particular piece of ground.
a) Look for the term **cluster** in the alphabetical index.
b) Find the term from the set code.
c) By reading the definition of *cluster* and the definitions of related terms, it can be seen that **clump,** just below *cluster* in the set, is the correct term to use.

4 *Revising the terms of a particular topic*
a) Select the subject area either from the list of *Contents*, or by selecting key terms from the alphabetical index.
b) Find the relevant part of the dictionary and study the terms. This will, in many cases, provide a revision, or summary, of the topic.

The definition

Each definition gives as much information as possible about the meaning and behaviour of the term. The definition itself is usually supplemented by typical examples of the term in context. Many definitions also carry examples of the term's collocation, that is the combination or phrase in which the term most frequently appears. Related forms of the headword (see Appendix 1) are shown when they are used in scientific contexts. If a related form is defined elsewhere in the dictionary it appears in small capital letters.

References

Other terms that add to the reader's understanding of the definition are shown at the end of the entry. These references are marked with arrows to indicate their position in the dictionary. A downward pointing arrow (↓) indicates that the term is defined later in the same section of a set; an upward pointing arrow (↑) indicates that the term is defined earlier in the set. An arrow pointing sideways (→) is a cross-reference to a term in a different section of the set, or a member of another set; in either case the term must be located by means of the alphabetical index.

Many references are marked to show they have a meaning that stands in a particular relation to the term; for example, it may be opposite, or be very similar, in meaning. The following abbreviations are used to show these relationships (see also Appendix 2).

Ag	*gradable antonym*	(as in opposite terms such as *high* and *low* between which there is a continuous gradation of change)
An	*non-gradable antonym*	(as in opposite terms such as *plastic* and *elastic* between which there is a discontinuity in the change)
Cm	*complementary term*	(as when two terms cannot function independently of each other, such as *lock* and *key*, *male* and *female*)

Cn	*converse term*	(as in two terms between which there is a reference point, such as *above* and *below*)
Cs	*consequent term*	(as when one term follows on from another, as *solution* follows on from *solvation*)
H	*hyponym*	(a term whose meaning is included in the meaning of another term, as the meanings of *red, blue* and *green* are included in the term *coloured*)
I	*incompatible term*	(a term that involves the complete denial of its opposite, for example, a *perfect vacuum* is incompatible with *matter*)
P	*polar term*	(a term that cannot exist independently of another term; for example, the *north pole* and the *south pole* of a magnet are polar terms)
Sn	*cognate term*	(as when terms have some element of meaning in common, such as *ejection* and *exudation*)

Sample entry

book position code, headword and word class (part of speech)	**AB025 natural** (*adj.*)
definition	Describes substances existing in nature, substances produced by nature, or processes taking place without human action,
examples of the term in context	*e.g.* ***a*** natural gas which exists in pockets in the earth; ***b*** natural science is all sciences concerned with the physical world; ***c*** natural frequency is the frequency of vibration of a body when it is not affected by outside sources; ***d*** natural radioactivity is the radioactivity from naturally occurring substances
collocation	□ *natural gas is a naturally occurring substance*
related forms	—***naturally*** (*adv.*)
references	↓ ARTIFICIAL (I) · IMITATION · FREE · DISCRETE · AVAILABLE[2] · MATERIAL[2] · COMPOSED OF · IMPURE ↑ MATTER → SYNTHETIC

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BH Polymers and Glasses

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Appendix 1

Related forms

Related forms of terms are obtained by affixation. In section **AL** (Word Analysis) the affixes especially used for scientific terms have been described. Terms which are formed by affixation are also called derivatives. The affixes described below are some of those occurring in general speech which are useful for scientific terms. These affixes do not cover the full range of the English language as some have been omitted because they are unimportant as far as scientific terms are concerned. For those interested, a fuller statement of affixation in the English language is given in *A Grammar of Contemporary English* (R. Quirk, S. Greenbaum, G. Leech, and J. Svartvik, Longman, 1972)

Examples of derivation

fraction (noun) → fraction–ate (verb) → fraction–at–ing (adjective)
↓ ↓
fraction–al (adjective) fraction–at–ion (noun)

Examples of related forms

The most important derivative for scientific terms is 'fractionate', hence the related forms are: fraction, fractional, fractionation, fractionating. In the entry for **fractionate** (BB044) the related forms are shown in ***bold italics*** when the term is not described elsewhere and in SMALL CAPITALS when the term is described in another entry.

Prefixes

Negative Prefixes

PREFIX	MEANING	ADDED TO	EXAMPLE	COMMENT
un-	'the opposite of' 'not'	adjectives	stable → unstable	with gradable adjectives
		-ed or -ing participles	combined → uncombined saturated → unsaturated	
non-	'not'	adjectives	polar → nonpolar	with non-gradable adjectives
		nouns	metal → non-metal	
in-	as for un-	adjectives	soluble → insoluble miscible → immiscible reversible → irreversible	note change to im- before m/b/p, to il- before l, and ir- before r
dis-	as for un-	adjectives	charged → discharged	note borrowed forms, *e.g.* associate dissociate
		verbs	charge → discharge	
		abstract nouns	continuity → discontinuity	
a- **an-**	'lacking in' 'lack of'	adjectives	sexual → asexual	
		nouns	symmetry → asymmetry	

Prefixes which Reverse the State or Process

PREFIX	MEANING	ADDED TO	EXAMPLE	COMMENT
de-	'to reverse the action' 'to remove'	verbs	hydrate → dehydrate	
		abstract nouns derived from verbs	activation → deactivation	
dis-	similar to de-	verb, hence participles	connect → disconnect connected → disconnected	
		noun	connecting → disconnecting	

Other Prefixes

PREFIX	MEANING	ADDED TO	EXAMPLE	COMMENT
pseudo-	a) 'false'	a) nouns	cilium → pseudocilium podium → pseudopodium	
	b) 'has the appearance of the object, but is not truly the same'	b) adjectives	septate → pseudoseptate	
	c) 'like, or isomeric with'	c) word segments	-carp → pseudocarp acid → pseudo-acid	
anti-	a) 'opposite in position or direction'	a) nouns	peristalsis → antiperistalsis catalyst → anticatalyst	Note: some terms use a hyphen, *e.g.* anti-proton
	b) 'opposite in effect'	b) adjectives	biotic → antibiotic	
	c) 'acting against'	c) adjectives	petalous → antipetalous	
inter-	a) 'between, among'	a) nouns	breeding → interbreeding	
		b) adjectives	costal → intercostal	
	b) 'from one to another'	c) verbs	change → interchange connect → interconnect	

Suffixes

SUFFIX	MEANING	ADDED TO	EXAMPLE	COMMENT
	VERB→ NOUN			
-er, -or	'agential'	mainly dynamic verbs→ nouns	flex → flexor plasticize → plasticizer	
-ation	'state' → 'action'	abstract nouns	crystallize → crystallization	verbs in -fy and -ze
	ADJECTIVE→ NOUN			
-ness	'state or quality'	adjective → abstract noun	brittle → brittleness	
-ity	'state or quality'	adjective → abstract noun	malleable → malleability	often added to adjectives in -able, -ible, -al, -ic

Prefixes

SUFFIX	MEANING	ADDED TO	EXAMPLE	COMMENT
	VERB FORMING			
-ify	'causative'	noun/ adjective → verbs (*v.t.*)	acid → acidify	Note: many borrowed words change the stem, *e.g.* liquid → liquefy
-ize	'causative'	noun → verb (*v.t.*)	colour → decolorize platinum → platinize carbon → carbonize crystal → crystallize	
	NOUN→ ADJECTIVE			
-ary	'producing' 'connected with'	noun → adjective	saliva → salivary	
	SOME OTHER ADJECTIVE FORMING SUFFIXES			
-able	'able to be' 'worthy of being' 'ought to be'	transitive verbs → adjectives	reverse → reversible vary → variable	many borrowed words, *e.g.* edible mutable
	ADVERB FORMING SUFFIXES			
-ly	'in a manner'	adjective → adverb of manner	explosive →explosively	

In the examples given it is usually clear that the affix has been added to a word already known. There are some suffixes which appear quite often but the original word (underlying form) is less easily identified.

Explosives and *explosion* obviously have a connection: *-ive* occurs quite often and so does *-ion*. Both the two words have *explos-*. This is not a word in English now. In meaning *explode* seems very close. This change, explode to explosion, took place before the word was borrowed.

In scientific English there are many words like this, borrowed long ago from Latin or Greek, already changed in their original languages: -al, -ic, and -ous (-ious, -eous) are examples of endings. To all of these -ity can be added.

cause – causal – causality
(electr) – electric – electricity
curio – curious – curiosity

-al, -ic, -ive form gradable adjectives

-ous forms non-gradable adjectives

See also Section **AL** in the Basic Terms.

Appendix 2

References and relationships of terms

1. Many references are marked to show that they have a meaning that stands in a particular relation to the defined term. The following abbreviations are used to show these relations.

Ag *Gradable antonyms* as in opposite terms, such as *high* and *low*, between which there is a continuous change. The use of either of these terms is subjectively assessed by the observer. For example, if observer A is higher than observer B, then an object between them is low to observer A and high to observer B. Other examples of gradable antonyms include: *hot* and *cold*; *accurate* and *inaccurate*; *elementary* and *advanced*.

An *Non-gradable antonyms* as in opposite terms, such as *elastic* and *plastic*, between which the change is marked by a discontinuity. The use of these terms is assessed objectively and is independent of the observer. For example, a material can be either elastic or plastic and empirical observation will determine which it is, as in the case of a copper wire which is elastic under stress up to a certain limit (marking the discontinuity) and then becomes plastic when the elastic limit is exceeded.

Cn *Converse terms* such as *above* and *below* which imply there is a reference point between the two states to which the terms refer, *e.g. above and below the melting point of ice*, in which the melting point of ice is the reference point between the two states of water.

I *Incompatible terms* such as *matter* and *vacuum*, between which no change is possible, and the possibility of one denies the possibility of the other for whatever is under discussion. For example, *crystalline* and *amorphous* are incompatible, as a crystalline substance such as sodium chloride cannot be amorphous, and the existence of the crystalline substance denies the possibility of there being amorphous sodium chloride.

Cm *Complementary terms* such as *lock* and *key*, which cannot function independently of each other. They can exist separately from each other, but must be together in order to function.

P *Polar terms* such as *north* and *south*, when describing the poles of a magnet, which cannot exist independently of each other. For example, *anode* and *cathode* are polar terms, as one cannot exist without the other in an experiment on electric current.

Cs *Consequent terms* such as *stress* and *strain*, which imply that in a process one condition is the consequence of the other. For example, when a *stress* is applied to a wire, the wire experiences a *strain*, and the strain is the consequence of the stress. Note that stress is not the consequent of strain.

H *Hyponyms* such as *blue* and *coloured*, in which the meaning of one term is included in the meaning of the other. For example, a *coloured* object can be red, *blue*, green or any other colour. *Blue* is a hyponym of *coloured* as its meaning is included in the meaning of coloured. Note that coloured is not a hyponym of blue.

Sn *Cognate terms* such as *replace* and *exchange*, which have some element of meaning in common. More than two terms can show a cognate relation, e.g. *improve*, *enhance*, *assist*, *aid*, *advance*, all have an element in common of causing a process to function better, but they differ in the manner by which the process becomes better.

2. The references with arrows pointing upwards (↑) and downwards (↓) belong to the same section of a set and hence these terms will generally show some form of cognate relation, although other relations are not excluded. The cross-references with an arrow pointing across (→) indicate the term is in another section or another set, but a knowledge of its meaning is useful in further clarifying the term which is defined.

Appendix 3

Abbreviations

Abbreviations used in the index and in the definitions

(Bio.)
(Ch.)
(Ph.) } indicates the term is used in biology, chemistry, or physics.

Note: The same term may have different meanings in different subjects, *e.g.* 'nucleus' can have different meanings, in biology, physics, and chemistry. When a headword appears in more than one place in the dictionary, it is numbered, *e.g.*, **nucleus**[1], **nucleus**[2], etc. If no label is given for any of the three sciences, then the term is used generally.

(G.S.) abbreviation for 'General Speech'; it indicates the use of the term in written Standard English. If no (G.S.) definition of the term is given, its meaning can be found in a standard word list.

(*n.*) a noun, noun phrase, or noun group, *e.g. thermodynamics* is a noun; *second law of thermodynamics* is a noun phrase; *leaf movement* is a noun group.

(*pl.*) the plural of a noun when it does not follow the general rules, *e.g.* **stoma** (*n.,pl.* **stomata**).

(*n.pl.*) a noun which occurs in the plural, *e.g.* **thermodynamics.**

(*adj.*) an adjective or a part of a verb used as an adjective, *e.g. regular* (*adj.*); *fractionating* (*adj.*) as in *fractionating column*; *varied* (*adj.*) as in *varied* p.d.

(*v.t.,i.*) a verb which can be used transitively or intransitively.

(*v.i.*) a verb with an intransitive use.

(*v.t.*) a verb with a transitive use.

(*adv.*) an adverb.

(*pre.*) indicates a group of letters which form a prefix.

(*suff.*) indicates a group of letters which form a suffix.

(*abbr.*) indicates an abbreviation.

Common abbreviations used in science

abs.	absolute	d.	decomposed
a.c.	alternating current	d.c.	direct current
anhyd.	anhydrous	decomp.	decomposition
a.p.	atmospheric pressure	dil.	dilute
approx.	approximately	dist.	distilled
aq.	aqueous	e.g.	(*exempli gratia*) for example
b.p.	boiling point	e.m.f.	electromotive force
c.g.	centre of gravity	eqn.	equation
coeff.	coefficient	expt.	experiment
conc.	concentrated	fig.	figure (diagram)
concn.	concentration	f.p.	freezing point
const.	constant	f.s.d.	full-scale deflection
crit.	critical	h.	hour
cryst.	crystalline		

Appendix 3

hyd.	hydrated	r.m.m.	relative molecular mass
i.e.	(*id est*) that is	r.m.s.	root mean square
insol.	insoluble	sol.	soluble
i.r.	infra-red	soln.	solution
liq.	liquid	sp.	specific
M.A.	mechanical advantage	sq.	square
max.	maximum	s.t.p.	standard temperature and pressure
min.	minimum		
m.p.	melting point	temp.	temperature
p.d.	potential difference	u.v.	ultra-violet
ppt.	precipitate	vac.	vacuum
r.a.m.	relative atomic mass	v.d.	vapour density
r.d.	relative density	V.R.	velocity ratio
r.h.	relative humidity	wt.	weight

Appendix 4

Prefixes for SI units

MULTIPLE	PREFIX	SYMBOL
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Appendix 5

1) SI units

Basic units

Système International d'Unités (SI) was adopted in 1960 by an international committee as a basic system of units. SI is based on seven basic units, each of which is defined with great accuracy. These units are:

the metre – defined from a wavelength in the spectrum of krypton
the kilogramme – defined from the mass of a prototype
the second – defined from a frequency in the spectrum of caesium
the ampere – defined from a newton and a metre
the kelvin – defined from the freezing point of water in contact with ice
the mole – defined from the carbon-12 isotope
the candela – a measurement of intensity of light

All other SI units are derived from these basic units. Under the system, each physical quantity has only one particular unit for its measurement, *e.g.* a length is only measured in metres. If the number employed with a basic unit is very large, or very small, then one of the prefixes given in Appendix 4 can be used, *e.g.* km or μm are used instead of metres. When numbers are written with units, a decimal point is used to indicate a fraction of a unit, but no comma is used to separate multiples of a thousand: a space is used instead for numbers over 10 000. Here are some examples:

Two thousand three hundred and twenty one metres is: 2321 m; this is preferably written as: 2·321 km.

Twenty three thousand and forty one metres is: 23 041 m; this is preferably written as 23·041 km.

For decimal fractions, groups of three figures are also used, *e.g.* 2·301 206 s.

Symbols for physical quantities

The symbol for a physical quantity is a single letter taken from the Latin or the Greek alphabet. When printed, the letter is in *italics*. Thus *t* indicates time. As time is measured in seconds (the SI unit), there is no need to state the unit.

For example:

'a time *t* seconds' is INCORRECT.

'a time *t*' is CORRECT.

'$pV = rT$ where p is the pressure, V the volume, r the gas constant, and T the thermodynamic temperature' is CORRECT, as p, V, r, T can only be measured in Nm^{-2}; m^3; N.m; a ratio. A list of SI symbols for physical quantities is given in Appendices 5.2 and 5.3. Occasionally, to avoid confusion, other symbols may be adopted, as for example in the wheel and axle where r and R are used for different radii. Alternatively, r_1 and r_2 could be used, but since R cannot be confused in this instance with any other physical quantity, it is convenient to use it.

Appendix 5

Use of the word 'specific'

This has been restricted to the meaning 'divided by mass'. Thus heat capacity is applicable to an object of a given material and specific heat capacity is the heat capacity per kilogramme of the material. The extensive quantity is denoted by a capital letter, *e.g.* heat capacity has the symbol *C*, and the specific quantity is denoted by the corresponding lower case (i.e. small) letter, e.g. specific heat capacity is denoted by c, so $C/m = c$.

Symbols for units

These symbols are printed in roman, or upright, type. They remain unaltered in singular and plural and do not have a full stop after the symbol, except at the end of a sentence, e.g. 5 mm and 1 mm are correct symbols. Symbols that are derived from the name of a person have a capital letter, or begin with a capital letter, although the unit is not written with a capital letter. Examples are J for joule (named after Joule, the physicist); N for newton (named after Newton, the mathematician). All other symbols use lower case letters, *e.g.* s for second, m for metre.

Prefixes for units

The prefixes are written with no space between the letters, *e.g.* kN for kilonewtons, nm for nanometres.

Multiplication and division of units

The method of expressing the multiplication of units is:
A × n or A.n or A n (with one space between)
The division of units is shown as:
m/s or m s^{-1} (with one space between)
This avoids confusion in cases such as:
ms^{-1} and m s^{-1}
the first is read as 'per millisecond', the second as metres per second. With two units in the divisor, negative indices are preferable as ambiguity is avoided, *e.g.*
J K^{-1} kg^{-1} is preferable to J/K kg.

Recommended mathematical symbols

In addition to the normal symbols, used in arithmetic, the following are used with SI units:

$\neq$	not equal to	$>$	larger than
$\approx$	approximately equal to	$\geqslant$	larger than or equal to
$\propto$	proportional to	$\gg$	much larger than
$<$	smaller than	$\equiv$	identical to or equivalent to
$\leqslant$	smaller than or equal to	$\uparrow$	increases
$\ll$	much smaller than	$\downarrow$	decreases

Appendix 5

2) Quantities, units and symbols

QUANTITY	SYMBOL	SI UNIT	SYMBOL	DERIVATION
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1,\varphi_1,\alpha_1$	—	—	—
of incidence	i	degree or radian	°	—
of refraction	r	degree or radian	°	—
Bragg	θ	number	—	—
critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a/\Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L,N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equivalent	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e			
energy	E	joule	J	N m
kinetic	E_k	joule	J	N m. $E_k = \frac{1}{2}mv^2$
potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96 500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f./rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	
frequency	f	hertz	Hz	oscillations/time

Appendix 5

QUANTITY	SYMBOL	SI UNIT	SYMBOL	DERIVATION
gas constant	r	joule	J	energy
half-life, radioactivity	$t_{\frac{1}{2}}$	second	s	fundamental unit
heat capacity	C	$J\ K^{-1}$	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	$J\ K^{-1}\ kg^{-1}$	—	heat capacity/mass
heat, quantity of	q	joule	J	energy
height	h	metre	m	fundamental unit
image distance	v	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
self	L	henry	H	—
intensity of radiation	I	*a number*	—	
latent heat	L	joule	J	quantity of heat
—, specific	l	$J\ kg^{-1}$	—	quantity of heat
—, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
— number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
— of molecules	N	—	—	—
— of turns on coil	n	*a number*	—	—
— order of spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	$H\ m^{-1}$	—	henry/metre
— of vacuum	μ_o	$H\ m^{-1}$	—	—
—, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	$F\ m^{-1}$	—	farad/metre
— of vacuum	ε_o	$F\ m^{-1}$	—	farad/metre
—, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	$J\ s^{-1}$
pressure	p	pascal	Pa	$N\ m^{-2}$: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}

Appendix 5

QUANTITY	SYMBOL	SI UNIT	SYMBOL	DERIVATION
r.m.s. current	I_{rms}	ampere	A	see current
r.m.s. voltage	V_{rms}	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u, v	m s^{-1}	—	distance/time
—, angular	ω	$second^{-1}$	s^{-1}	angle/time
— of e.m. waves	c	m s^{-1}	—	—
— of sound	v	m s^{-1}	—	—
volume	V	metre cubed	m^3	$l \times b \times h$
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force × distance (N m)
weight	W	newton	N	kg m s^{-2} or mg

Appendix 5

3) Letters used as symbols for quantities

LETTER	QUANTITY
A	area, mass number
a	acceleration
B	magnetic flux density
b	breadth
C	capacitance, heat capacity
c	specific heat capacity, velocity of e.m. waves in vacuum, critical angle
d	relative density, thickness, distance apart
E	energy, electric field strength, electromotive force. E_k kinetic energy, E_p potential energy, E_0 peak e.m.f.
e	charge on electron (or proton), an electron
F	Faraday constant, force
f	frequency, focal length
G	free energy (ΔG), conductance
g	acceleration due to gravity
H	magnetic field strength, magnetizing force, heat of reaction (ΔH)
h	height
I	intensity of radiation, electric current. I_0 peak current
i	angle of incidence
k	a constant
L	self inductance, latent heat, Avogadro constant. L_m molar latent heat
l	length, specific latent heat
M	mutual inductance, molar solution
m	mass, electromagnetic moment, magnification
N	number of molecules, neutron number. N_A = Avogadro constant
n	a number, refractive index, number of moles, a neutron
P	power
p	pressure, order of a spectrum, a proton
Q	electric charge
q	quantity of heat
R	resistance. R_A anode slope resistance. molar gas constant
r	angle of refraction, gas constant (nR), radius
s	distance along a path, slit separation
T	period, thermodynamic (absolute) temperature, torque, tension, turns ratio
t	time. $t_{\frac{1}{2}}$ half-life
u	initial velocity, velocity of molecules, object distance
V	volume, electrical potential, potential difference. V_m molar volume
v	velocity, image distance, velocity of sound
W	weight
w	work

Appendix 5

LETTER	QUANTITY
X	reactance
Z	atomic number
z	charge on ion, electrochemical equivalent
α	an angle
Δ	an increment (finite)
ε	permittivity
η	efficiency
θ	temperature (Celsius), temperature difference, an angle, Bragg angle
λ	wavelength, decay constant
μ	permeability, amplification factor
π	ratio of circumference to diameter of circle
ρ	density, resistivity
Φ	magnetic flux
φ	an angle
ω	angular velocity

Appendix 6

Important values, constants and standards

1. s.t.p. = standard temperature and pressure, expressed as 1·00 atm or 760 mmHg or 101 kPa (= kN m^{-2}) (Pa = pascal)
   and
   0°C or 273·15 K
2. Temperature of triple point of water, 273·16 K
3. Gas constant, 8·314 J K^{-1} mol^{-1}
4. Standard volume of a mole of gas at s.t.p., 22·4 dm^3
5. The Faraday constant, F, $9{\cdot}65 \times 10^4$ C mol^{-1}
6. The Avogadro constant, L, $6{\cdot}02 \times 10^{23}$ mol^{-1}
7. The Planck constant, h, $6{\cdot}63 \times 10^{-34}$ J s
8. Speed of light, c, $3{\cdot}00 \times 10^8$ m s^{-1}
9. Mass of proton, ${}^1_1H$, $1{\cdot}67 \times 10^{-27}$ kg
   mass of neutron, ${}^1_0n$, $1{\cdot}67 \times 10^{-27}$ kg
   mass of electron, ${}^0_{-1}e$, $9{\cdot}11 \times 10^{-31}$ kg
   electronic charge, e, $-1{\cdot}60 \times 10^{-19}$ C
10. 1 cal = 4·18 J
11. 1 eV = $1{\cdot}60 \times 10^{-19}$ J
12. Specific heat capacity of water, 4·18 J g^{-1} K^{-1}
13. Ionic product of water, $K_w = 1{\cdot}008 \times 10^{-14}$ mol^2 dm^{-6}, at 289 K (25 °C)

Appendix 7

Common alloys

NAME OF ALLOY	APPROXIMATE PERCENTAGE COMPOSITION	USES
Brass	Cu 65–90; Zn 35–10	Decorative metal work
Bronze		
—common—	Cu 92; Sn 6; Zn 2	Machinery; decorative metal work
—aluminium—	Cu 90; Al 10	Castings—resists chemical wear
—coinage—	Cu 95; Sn 4; Zn 1	Coins; medals
Dentists' Amalgam	Hg 70; Cu 30	Dental fillings
Duralumin	Al 94; Cu 5; Mn 0·5; Mg 0·5	Building of aeroplanes, railway coaches and ships
Electron	Mg 93; Zn 5; Cu 2	Aeroplane frames
Gold		
—coinage—	Au 90; Cu 10	Coinage
—dental—	Au 58; Cu 14–28; Ag 28–14	Dental caps
Lead		
—battery plates—	Pb 94; Sb 6	Storage batteries
—type metal—	Pb 58; Sn 26; Sb 15; Cu 1	Printing industry
—solder—	Pb 67; Sn 33	For joining metals
Magnalium	Al 70–90; Mg 30–10	Scientific apparatus, and castings
Manganin	Cu 82·5; Mn 16; Ni 1·5	Electrical apparatus— it has a fairly constant electrical resistance
Silver		
—coinage—	Ag 90; Cu 10	Coinage

Appendix 8

Table of chemical elements

ELEMENT	SYMBOL	ATOMIC NUMBER	REL. ATOMIC MASS	OXIDATION NUMBER
actinium	Ac	89	227·00	—
aluminium	Al	13	26·98	3
americium	Am	95	243·00	—
antimony	Sb	51	121·75	3, 5
argon	A	18	39·95	0
arsenic	As	33	74·92	3, 5
astatine	At	85	210·00	—
barium	Ba	56	137·34	2
berkelium	Bk	97	249·00	—
beryllium	Be	4	9·01	2
bismuth	Bi	83	208·98	3, 5
boron	B	5	10·81	3
bromine	Br	35	79·91	1, 3, 5, 7
cadmium	Cd	48	112·40	2
calcium	Ca	20	40·08	2
californium	Cf	98	251·00	—
carbon	C	6	12·01	2, 4
cerium	Ce	58	140·12	3, 4
caesium	Cs	55	132·91	1
chlorine	Cl	17	35·45	1, 3, 5, 7
chromium	Cr	24	51·99	2, 3, 6
cobalt	Co	27	58·93	2, 3
columbium, *see* niobium				
copper	Cu	29	63·54	1, 2
curium	Cm	96	247·00	—
dysprosium	Dy	66	162·5	3
einsteinium	Es	99	254·00	—
erbium	Er	68	167·26	3
europium	Eu	63	151·96	2, 3
fermium	Fm	100	253·00	—
fluorine	F	9	18·99	1
francium	Fr	87	223·00	1
gadolinium	Gd	64	157·25	3
gallium	Ga	31	69·72	2, 3
germanium	Ge	32	72·59	4
gold	Au	79	196·97	1, 3
hafnium	Hf	72	178·49	4
helium	He	2	4·00	0
holmium	Ho	67	164·93	3
hydrogen	H	1	1·00	1
indium	In	49	114·82	3
iodine	I	53	126·90	1, 3, 5, 7
iridium	Ir	77	192·20	3, 4
iron	Fe	26	55·85	2, 3
krypton	Kr	36	83·80	0
lanthanum	La	57	138·91	3
lead	Pb	82	207·19	2, 4

Appendix 8

ELEMENT	SYMBOL	ATOMIC NUMBER	REL. ATOMIC MASS	OXIDATION NUMBER
lithium	Li	3	6·94	1
lutetium	Lu	71	174·97	3
magnesium	Mg	12	24·31	2
manganese	Mn	25	54·94	2, 3, 4, 6, 7
mendelevium	Md	101	256·00	—
mercury	Hg	80	200·59	1, 2
molybdenum	Mo	42	95·94	3, 4, 5, 6
neodymium	Nd	60	144·27	3
neon	Ne	10	20·18	0
neptunium	Np	93	237·00	—
nickel	Ni	28	58·71	2, 3
niobium (columbium)	Nb	41	92·91	3, 4, 5
nitrogen	N	7	14·01	3, 5
nobelium	No	102	254·00	—
osmium	Os	76	190·20	2, 3, 4, 6, 8
oxygen	O	8	15·99	2
palladium	Pd	46	106·40	2, 3, 4
phosphorus	P	15	30·97	3, 5
platinum	Pt	78	195·09	2, 4
plutonium	Pu	94	242·00	—
polonium	Po	84	210·00	—
potassium	K	19	39·10	1
praseodymium	Pr	59	140·91	3
promethium	Pm	61	147·00	3
protactinium	Pa	91	231·00	—
radium	Ra	88	226·00	2
radon	Rn	86	222·00	0
rhenium	Re	75	186·22	4, 6, 7
rhodium	Rh	45	102·91	3, 4
rubidium	Rb	37	85·47	1
ruthenium	Ru	44	101·07	3, 4, 6, 8
samarium	Sm	62	150·35	2, 3
scandium	Sc	21	44·97	3
selenium	Se	34	78·96	2, 4, 6
silicon	Si	14	28·09	4
silver	Ag	47	107·87	1
sodium	Na	11	22·98	1
strontium	Sr	38	87·62	2
sulphur	S	16	32·06	2, 4, 6
tantalum	Ta	73	180·95	5
technetium	Tc	43	99·00	—
tellurium	Te	52	127·60	2, 4, 6
terbium	Tb	65	158·92	3
thallium	Tl	81	204·37	1, 3
thorium	Th	90	232·04	4
thulium	Tm	69	168·93	3
tin	Sn	50	118·69	2, 4
titanium	Ti	22	47·90	3, 4
tungsten (wolfram)	W	74	183·85	6
uranium	U	92	238·03	4, 6
vanadium	V	23	50·94	2, 3, 4, 5
xenon	Xe	54	131·30	0
ytterbium	Yb	70	173·04	3

Appendix 8

ELEMENT	SYMBOL	ATOMIC NUMBER	REL. ATOMIC MASS	OXIDATION NUMBER
yttrium	Y	39	88·91	3
zinc	Zn	30	65·37	2
zirconium	Zr	40	91·22	4

Appendix 9

Ionization energies (1st, 2nd and 3rd) of selected elements, in kJ mol^{-1}

	ATOMIC NUMBER	FIRST	SECOND	THIRD
H	1	1310	—	—
He	2	2370	5250	—
Li	3	519	7300	11800
Be	4	900	1760	14800
B	5	799	2420	3660
C	6	1090	2350	4610
N	7	1400	2860	4590
O	8	1310	3390	5320
F	9	1680	3370	6040
Ne	10	2080	3950	6150
Na	11	494	4560	6940
Mg	12	736	1450	7740
Al	13	577	1820	2740
Si	14	786	1580	3230
P	15	1060	1900	2920
S	16	1000	2260	3390
Cl	17	1260	2300	3850
Ar	18	1520	2660	3950
K	19	418	3070	4600
Ca	20	590	1150	4940
Cr	24	653	1590	2990
Mn	25	716	1510	3250
Fe	26	762	1560	2960
Ni	28	736	1750	3390
Cu	29	745	1960	3550
Zn	30	908	1730	3828
As	33	966	1950	2730
Br	35	1140	2080	3460
Sr	38	548	1060	4120
Sn	50	707	1410	2940
Sb	51	833	1590	2440
I	53	1010	1840	2040
Ba	56	502	966	3390
Pb	82	716	1450	3080
Bi	83	774	1610	2460

Appendix 10

Useful standard electrode and redox potentials (at 298 K = 25°C)

Electrode reaction	$E^{\ominus}$/V
$Ag^+ + e^- \rightarrow Ag$	+0·80
$AgCl + e^- \rightarrow Ag + Cl^-$	+0·22
$Ag(NH_3)_2^+ + e^- \rightarrow Ag + 2NH_3$	+0·37
$Al^{3+} + 3e^- \rightarrow Al$	−1·66
$Ba^{2+} + 2e^- \rightarrow Ba$	−2·90
$Be^{2+} + 2e^- \rightarrow Be$	−1·85
$\frac{1}{2}Br_2 + e^- \rightarrow Br^-$	+1·07
$Ca^{2+} + 2e^- \rightarrow Ca$	−2·87
$Ce^{4+} + e^- \rightarrow Ce^{3+}$	+1·45
$\frac{1}{2}Cl_2 + e^- \rightarrow Cl^-$	+1·36
$HOCl + H^+ + e^- \rightarrow \frac{1}{2}Cl_2 + H_2O$	+1·64
$Cr^{3+} + 3e^- \rightarrow Cr$	−0·74
$Cr^{3+} + e^- \rightarrow Cr^{2+}$	−0·41
$\frac{1}{2}Cr_2O_7^{2-} + 7H^+ + 3e^- \rightarrow Cr^{3+} + 7/2H_2O$	+1·33
$Cu^{2+} + 2e^- \rightarrow Cu$	+0·34
$Cu^{2+} + e^- \rightarrow Cu^+$	+0·15
$Cu(NH_3)_4^{2+} + 2e^- \rightarrow Cu + 4NH_3$	−0·05
$D^+ + e^- \rightarrow \frac{1}{2}D_2$	−0·003
$\frac{1}{2}F_2 + e^- \rightarrow F^-$	+2·87
$Fe^{2+} + 2e^- \rightarrow Fe$	−0·44
$Fe^{3+} + 3e^- \rightarrow Fe$	−0·04
$Fe^{3+} + e^- \rightarrow Fe^{2+}$	+0·77
$Fe(CN)_6^{3-} + e^- \rightarrow Fe(CN)_6^{4-}$	+0·36
$H^+ + e^- \rightarrow \frac{1}{2}H_2$	0·00
$\frac{1}{2}H_2 + e^- \rightarrow H^-$	−2·25
$\frac{1}{2}I_2 + e^- \rightarrow I^-$	+0·54
$IO_3^- + 6H^+ + 5e^- \rightarrow \frac{1}{2}I_2 + 3H_2O$	+1·19
$K^+ + e^- \rightarrow K$	−2·92
$Li^+ + e^- \rightarrow Li$	−3·04
$Mg^{2+} + 2e^- \rightarrow Mg$	−2·38
$Mn^{2+} + 2e^- \rightarrow Mn$	−1·18
$MnO_2 + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O$	+1·23
$MnO_4^- + e^- \rightarrow MnO_4^{2-}$	+0·56
$MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$	+1·67
$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$	+1·52
$HNO_2 + H^+ + e^- \rightarrow NO + H_2O$	+0·99
$NO_3^- + 2H^+ + e^- \rightarrow NO_2 + H_2O$	+0·81
$NO_3^- + 3H^+ + 2e^- \rightarrow HNO_2 + H_2O$	+0·94
$NO_3^- + 4H^+ + 3e^- \rightarrow NO + 2H_2O$	+0·96
$NO_3^- + 5H^+ + 4e^- \rightarrow \frac{1}{2}N_2O + 5/2H_2O$	+1·11
$NO_3^- + 6H^+ + 5e^- \rightarrow \frac{1}{2}N_2 + 3H_2O$	+1·24
$NO_3^- + 10H^+ + 8e^- \rightarrow NH_4^+ + 3H_2O$	+0·87
$Na^+ + e^- \rightarrow Na$	−2·71
$Ni^{2+} + 2e^- \rightarrow Ni$	−0·25

Appendix 10

$\frac{1}{2}H_2O_2+H^++e^- \rightarrow H_2O$	+1·77
$\frac{1}{2}O_2+2H^++2e^- \rightarrow H_2O$	+1·23
$\frac{1}{2}O_2+H_2O+2e^- \rightarrow 2OH^-$	+0·40
$O_2+2H^++2e^- \rightarrow H_2O_2$	+0·68
$O_3+2H^++2e^- \rightarrow O_2+H_2O$	+2·07
$Pb^{2+}+2e^- \rightarrow Pb$	−0·13
$Pb^{4+}+2e^- \rightarrow Pb^{2+}$	+1·69
$PbO_2+4H^++2e^- \rightarrow Pb^{2+}+2H_2O$	+1·47
$S+2e^- \rightarrow S^{2-}$	−0·51
$S+2H^++2e^- \rightarrow H_2S$	+0·14
$SO_4^{2-}+4H^++2e^- \rightarrow H_2SO_3+H_2O$	+0·17
$\frac{1}{2}S_4O_6^{2-}+e^- \rightarrow S_2O_3^{2-}$	+0·09
$Sn^{2+}+2e^- \rightarrow Sn$	−0·14
$Sn^{4+}+2e^- \rightarrow Sn^{2+}$	+0·15
$Zn^{2+}+2e^- \rightarrow Zn$	−0·76

Appendix 11

The Greek alphabet

CAPITAL	SMALL	NAME	ENGLISH EQUIVALENT
Α	α	alpha	a
Β	β	beta	b
Γ	γ	gamma	g
Δ	δ	delta	d
Ε	ε	epsilon	e (short)
Ζ	ζ	zeta	z
Η	η	eta	e (long)
Θ	θ	theta	th
Ι	ι	iota	i
Κ	κ	kappa	k
Λ	λ	lambda	l
Μ	μ	mu	m
Ν	ν	nu	n
Ξ	ξ	xi	x
Ο	ο	omicron	o (short)
Π	π	pi	p
Ρ	ρ	rho	r
Σ	σ	sigma	s
Τ	τ	tau	t
Υ	υ	upsilon	u
Φ	φ	phi	ph
Χ	χ	chi	ch
Ψ	ψ	psi	ps
Ω	ω	omega	o (long)

Appendix 12

Naming chemical compounds

In this book the authors have used the systematic names recommended by the commissions of the International Union of Pure and Applied Chemistry (IUPAC) and the rules relating to these names. Because there is a variety of practice in different countries, and within different countries, in the use of chemical names, an appendix is included here which gives the more common of the changes from the traditional unsystematic names formerly used to the present IUPAC recommendations.

Rules for naming inorganic compounds

Metal ions

a) Metals of fixed oxidation state: the name, by itself, of the metal is used. For example: sodium nitrate; aluminium chloride.

b) Metals of variable oxidation state: a Roman numeral is used after the name of the metal to indicate its oxidation state. For example:

$FeCl_2$ iron (II) chloride
$FeCl_3$ iron (III) chloride
CuCl copper (I) chloride

Acids and their ions

a) Binary acids retain the systematic ending *-ide* for their ions, *e.g.* chloride, bromide ions.

b) Oxoacids (acids containing oxygen) and their ions are described in terms of the oxidation number of the non-metal forming the acid. If the non-metal has a fixed oxidation number, the name by itself is used.

Formula of ion	*Recommended name*	*Former name*
CO_3^{2-}	carbonate	carbonate
ClO_3^-	chlorate (V)	chlorate
ClO^-	chlorate (I)	hypochlorite
NO_3^-	nitrate (V)	nitrate
NO_2^-	nitrate (III)	nitrite
PO_4^{3-}	phosphate (V)	orthophosphate
SO_4^{2-}	sulphate (VI)	sulphate
SO_3^{2-}	sulphate (IV)	sulphite

c) The corresponding acids are named from the ions, with the exception of binary acids.

Formula of acid	*Recommended name*	*Former name*
HCl	hydrochloric acid	hydrochloric acid
$HClO_3$	chloric (V) acid	chloric acid
HClO	chloric (I) acid	hypochlorous acid
HNO_3	nitric (V) acid	nitric acid
HNO_2	nitric (III) acid	nitrous acid

d) The oxoacids of metals and their ions are described in terms of the oxidation state of the metal. For metals of fixed oxidation state, the Roman numeral indicating the oxidation state is usually omitted.

The names of the ions are formed in the following way:

i) In the anion the ending of the name of the metal (*-ium*) is replaced by the ending *-ate*, *e.g.*
aluminium becomes aluminate
chromium becomes chromate
manganese becomes manganate

or

ii) the ending *-ate* is added to the name of the metal, *e.g.*
zinc becomes zincate

or

iii) the following exceptions are made to the rule:
copper becomes cuprate (from *cuprum*)
gold becomes aurate (from *aurum*)
iron becomes ferrate (from *ferrum*)
lead becomes plumbate (from *plumbum*)
silver becomes argentate (from *argentum*)
tin becomes stannate (from *stannum*)

EXAMPLES:

Formula of ion	*Recommended name*	*Former name*
CrO_4^{2-}	chromate (VI)	chromate
$Cr_2O_7^{2-}$	dichromate (VI)	dichromate
MnO_4^{2-}	manganate (VI)	manganate
MnO_4^-	manganate (VII)	permanganate
SnO_3^{2-}	stannate (IV)	stannate
SnO_2^{2-}	stannate (II)	stannite
ZnO_2^{2-}	zincate	zincate

Salts, other than binary compounds

a) The following examples indicate the use of numerical prefixes in describing compounds:

Formula	*Recommended name*	*Former name*
$NaHSO_4$	sodium hydrogen sulphate	sodium bisulphate
Na_2HPO_4	disodium hydrogen phosphate (V)	sodium hydrogen orthophosphate
$Ca(HCO_3)_2$	calcium hydrogen carbonate	calcium bicarbonate
Fe_3O_4	iron (II) diiron (III) oxide	ferrosoferric oxide (magnetic oxide of iron)
Na_3PO_4	trisodium phosphate (V)	sodium orthophosphate

b) Hydrates are indicated by adding a hyphen to the name of the anhydrous substance, then an Arabic numeral stating the stoichiometric proportion of water, followed by a hyphen, and then the word 'water', *e.g.*

$CaSO_4$, $\frac{1}{2}H_2O$ is calcium sulphate (VI)-$\frac{1}{2}$-water

$CuSO_4$, $5H_2O$ is copper (II) sulphate (VI)-5-water

When the extent of hydration is not known, or uncertain, the term 'hydrated' is placed before the name of the anhydrous substance.

c) *Complex ions, coordination compounds*

The ions or groups of atoms attached to a 'central' atom are listed in

alphabetical order with numerical prefixes giving the number of such ions or groups. Water is indicated by the word 'aqua'.

EXAMPLES:

Formula	*Recommended name*	*Former name*
$[Cu(4H_2O)]^{2+}$	tetraaqua copper (II) ion	hydrated cupric ion
$K_4Fe(CN)_6$	(tetra)potassium hexacyanoferrate (II)	potassium ferrocyanide
$K_3Fe(CN)_6$	(tri)potassium hexacyanoferrate (III)	potassium ferricyanide
$Na_2Fe(NO)(CN)_5$	(di)sodium pentacyanonitrosyl-ferrate (II)	sodium nitroprusside
$[Cu(NH_3)_4]SO_4$	tetraammine copper (II) sulphate (VI)	cuprammonium sulphate

Non-metal compounds

When the stoichiometrical proportions of a molecule are known, the proportions are shown by Greek numerical prefixes; in some cases, the prefix *mono-* is not used. If discrete molecules of a compound have a doubtful existence, then the oxidation number of the least electronegative element is indicated by a Roman numeral.

EXAMPLES:

Formula	*Recommended name*	*Former name*
CO_2	carbon dioxide	carbon dioxide
CO	carbon monoxide	carbon monoxide
N_2O	dinitrogen oxide	nitrous oxide
NO	nitrogen oxide	nitric oxide
NO_2	nitrogen dioxide	nitrogen dioxide (nitrogen peroxide)
SO_2	sulphur dioxide	sulphur dioxide
SO_3	sulphur (VI) oxide	sulphur trioxide
N_2O_4	dinitrogen tetroxide	nitrogen tetroxide
S_2Cl_2	disulphur dichloride	sulphur monochloride
SO_2Cl_2	sulphur dichloride dioxide	sulphuryl chloride
PCl_3	phosphorus trichloride	phosphorus trichloride
PCl_5	phosphorus pentachloride	phosphorus pentachloride
Metallic oxides		
Na_2O_2	sodium peroxide	sodium peroxide
MnO_2	manganese (IV) oxide	manganese dioxide
Cr_2O_3	chromium (III) oxide	chromium sesquioxide

Rules for naming organic compounds

Systematic names

These names are built up by joining syllables derived from the following rules:

a) A syllable is used to denote the number of carbon atoms in the *longest unbranched carbon chain* in the compound. The number of

carbon atoms thus formulates a saturated hydrocarbon and the specific compound is regarded as a substituted hydrocarbon.

The systematic syllables are:

Syllable:	meth-	eth-	prop-	but-	pent-	hex-	hept-	oct-	non-	dec-
No. of C atoms:	1	2	3	4	5	6	7	8	9	10

b) A syllable to indicate the type of bond between the carbon atoms:

Bond:	single	double	triple
Syllable:	-an-	-en-	-yn-

c) A syllable to indicate a functional group:

Formula	*Group name*	*Syllable*
$-C_nH_{2n+1}$	hydrocarbon chain	-yl
—OH	alcohol	-ol
—CHO	aldehyde	-al
=CO	ketone	-one
—COOH	carboxylic acid	-oic acid -carboxylic acid
—Cl	chloride	chloro-
$-NH_2$	amino	-amine amino-
$-CONH_2$	amide	-amide
$-C(=O)Hal$	acyl halide	-oyl halide
—C≡N	nitrile (cyanide)	-onitrile
$-NO_2$	nitro	nitro-
—SH	mercaptan	-thiol

Hydrocarbon chains

In a branching chain, the syllable for the number of carbon atoms is joined to the syllable -yl; *e.g.* methyl; ethyl; propyl. The carbon atom in the longest chain, to which the branch chain is bonded, is numbered, for hydrocarbons, from either end, and this number is indicated by an Arabic numeral placed in front of the branch chain syllable. For carbon chains possessing a functional group, the carbon atom attached to the functional group is numbered 1, and the remaining atoms in the chain are then numbered consecutively. Example of a branched chain hydrocarbon:

$CH_3CH_2CH(C_3H_7)CH_2CH_2CH_3$ 3-propyl hexane
or 4-propyl hexane

(6 carbon atoms in the longest chain, so a substituted hexane; the branch chain is attached to the 3rd atom from one end or the 4th from the other.)

Example of a branched chain substituted hydrocarbon:

$CH_3CH_2CH(C_3H_7)CH_2CH_2CH_2OH$ 4-propyl hexan-1-ol

(Substituted hexane; numbered 1 from the carbon atom in the functional group of an alcohol; -1-ol shows the functional group; 4-propyl indicates the branch chain.)

Halogen compounds

a) Greek prefixes are used to indicate the number of halogen atoms, except for a monosubstituted compound, *e.g.*

Formula	*Systematic name*	*Former name*
CH_3Cl	chloromethane	methyl chloride
CH_2Cl_2	dichloromethane	methylene dichloride
$CHCl_3$	trichloromethane	chloroform
CCl_4	tetrachloromethane	carbon tetrachloride
CH_3Br	bromomethane	methyl bromide
CH_3I	iodomethane	methyl iodide

b) Arabic numerals are used to denote the carbon atoms in the carbon chain, to which halogen atoms are bonded, *e.g.*

Formula	*Systematic name*	*Former Name*
CH_2Br | CH_2Br	1,2-dibromoethane	ethylene dibromide
$CHBr_2$ | CH_3	1,1-dibromoethane	ethylidene dibromide
C_3H_7Cl	1-chloropropane	n-propyl chloride
$CH_3CHI.CH_3$	2-iodopropane	isopropyl iodide

Alcohols

Homologous series of primary, secondary, and tertiary alcohols are given systematic names as below:

Formula	*Systematic name*	*Former name*
CH_3OH	methanol	methyl alcohol
C_2H_5OH	ethanol	ethyl alcohol
C_3H_7OH	propanol	propyl alcohol
$CH_3CHOH.CH_3$	propan-2-ol	isopropyl alcohol
$CH_3CH.CH_3CH_2OH$	2-methyl propan-1-ol	isobutyl alcohol
CH_2OH | CH_2OH	ethan-1,2-diol	ethyl glycol
CH_2OH | $CHOH$ | CH_2OH	propan-1,2,3-triol	glycerol

Aldehydes and ketones

Formula	*Systematic Name*	*Former Name*
$HCHO$	methanal	formaldehyde
CH_3CHO	ethanal	acetaldehyde
C_2H_5CHO	propanal	propaldehyde
$(CH_3)_2CO$	propanone	acetone

Carboxylic acids

Homologous series of carboxylic acids, and substituted acids, are given systematic names as below. When numbering carbon atoms, that of the carboxyl group is taken as 1, *e.g.*

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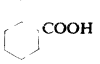
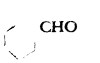
Formula	*Recommended name*	*Former name*
CH_3COOH	ethanoic acid	acetic acid
$CH_3CH_2CH_2COOH$	butanoic acid	butyric acid
$CH_3CH_2CH.NH_2COOH$	2-aminobutanoic acid	α aminobutyric acid
$CH_2ClCH_2CH.NH_2COOH$	2-amino-4-chlorobutanoic acid	1-amino 3-chloro butyric acid
COOH.COOH	ethanedioic acid	oxalic acid
CH(OH)COOH.CHOH.COOH	2,3-dihydroxy-butanedioic acid	tartaric acid
$CH_2COOH.CH(OH)COOH.CH_2COOH$	2-hydroxypropane-1,2,3-tricarboxylic acid	citric acid
$C_{17}H_{35}COOH$	octadecanoic acid	stearic acid
$C_{15}H_{31}COOH$	hexadecanoic acid	palmitic acid
$CH_3(CH_2)_7CH=CH(CH_2)_7COOH$	octadec-9-enoic acid	oleic acid

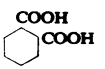
Other aliphatic compounds

Formula	*Recommended name*	*Former name*
$C_2H_5NH_2$	ethylamine	ethylamine
$C_2H_5NH_3Cl$	ethylammonium chloride	ethylamine hydrochloride
CH_3CONH_2	ethanamide	acetamide
CH_3COCl	ethanoyl chloride	acetyl chloride
$CH_3CO\diagdown O\diagup CH_3CO$	ethanoic anhydride	acetic anhydride
C_2H_5CN	propanonitrile	ethyl cyanide
C_2H_5NC	isocyanoethane	ethyl isocyanide
$C_2H_5NO_2$	nitroethane	nitroethane
C_2H_5SH	ethanthiol	ethyl mercaptan

Aromatic compounds

a) Aromatic compounds without side chains are named with benzene as the root with the following prefixes and suffixes to indicate functional groups. With two substituted groups, the carbon atom of one group is labelled 1, and the others 2-6 respectively, with the second or third group placed as close as possible to the first group. If the side chains form homologues of benzene, the compounds are named as alkylbenzenes. The following examples illustrate these rules.

Formula	*Recommended name*	*Former name*
	ethyl benzene	ethylbenzene
	benzenecarboxylic acid	benzoic acid
	benzenecarbaldehyde	benzaldehyde

	chlorobenzene	chlorobenzene
	benzenecarboxamide	benzamide
	nitrobenzene	nitrobenzene
	1,2-dichlorobenzene	orthodichloro-benzene
	1,3-dinitrobenzene	metadinitro-benzene
	1,4-dichlorobenzene	paradichloro-benzene
	benzene-1,2-dicarboxylic acid	phthalic acid
	benzene-1,3-diol	resorcinol
	methyl benzene	toluene
	1,3-dimethyl-benzene	metaxylene
	2-hydroxybenzene-carboxylic acid	salicylic acid

b) Aromatic compounds with side chains containing functional groups are named as phenyl substituted aliphatic compounds taking C_6H_5 as the phenyl group. The name thus recommended places emphasis on the part of the structure most likely to take part in reactions. The following examples illustrate these rules.

Formula	*Recommended name*	*Former name*
	phenol (compare benzene-1,3-diol)	phenol

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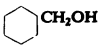
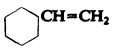
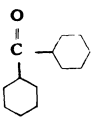
	phenylamine	aniline
	phenylethanone	acetophenone
	phenylmethanol	benzyl alcohol
	phenylethene	styrene
	diphenylmethanone	benzophenone
	methoxybenzene	anisole

Fused aromatic rings
The terms naphthalene and anthracene are used.

Basic Terms

Space

AA001 space[1] (*n.*) **1** That which objects occupy as a result of their volume, *i.e.* any solid object occupies space. The amount of space occupied is the volume of the object. No two objects can be in the same region of space at the same time. Space is said to have three dimensions, *i.e.* any solid object has three dimensions (length, width and height). **2** A part or portion of space; a volume, area or length that may be empty or occupied by something, *e.g.* ***a*** a space on the shelf between two bottles into which something may be put; ***b*** a blank space on an examination paper (part of the paper with no writing on it). **3** The universe, containing the galaxies, stars, planets, and other stellar objects. **4** A period of time, *e.g.* ***a*** the space between two events; ***b*** he finished the work in a short space of time □ *three-dimensional space; a space between two objects; a space of two hours* —SPACE (*v.*) · SPATIAL (*adj.*) ↓ PLACE · BOUNDARY · PATH RANGE · SURFACE[1] · SPACE[2] · OCCUPY · SPATIAL · EXTENSIVE · SURROUNDINGS · JOIN[1] · CRACK · MATTER · FORM[1] · CAUSE · WHOLE

AA002 place (*n.*) **1** A part of space; an area or volume of space either occupied by an object or organism or unoccupied, *e.g.* ***a*** a laboratory is a place where experiments are performed; ***b*** every student has his own place in the classroom —PLACE (*v.*) ↓ POSITION (Sn) · POINT · IN SITU · OCCUPATION · OCCUPANT · VACATION · EVACUATION ↑ SPACE[1] → LOCATION[1] (Sn) · SITE[1] (Sn) · SITUATION (Sn)

AA003 position (*n.*) Position is place in relation to other objects or individuals. It is a part in relation to the configuration of the whole; also, for individual animals, it is the configuration of the body as modified by the parts, *e.g.* ***a*** the properties of an element depend upon its position in the periodic table (its place in relation to other elements); ***b*** an animal takes up different positions such as lying, sitting, crouching (the animal takes up different configurations of its body); ***c*** the position of the image formed by a lens from an object is fixed in relation to the lens and object □ *to locate the position of an image* —POSITION (*v.*) ↑ PLACE (Sn) → LOCATION (Sn) · SITUATION (Sn) · CONFIGURATION

AA004 point (*n.*) **1** A point has a definite position but no size (extent in space); it is the intersection of two lines. **2** A definite value of some measured quantity, *e.g.* ***a*** the point at which water boils (the temperature at which it boils); ***b*** an event occurs at a definite point in time. ↑ PLACE · POSITION

AA005 *in situ* (*adv.*) In the place where it is needed, *e.g.* in the thermit welding process molten iron is produced *in situ* (at the point where the molten iron is needed to join together two pieces of steel). ↑ PLACE

AA006 occupation (*n.*) The state of being in a given position or place, or moving into a given position or place. —OCCUPANT (*n.*) OCCUPY (*v.*) ↓ VACATION (Cn) ↑ PLACE → OCCUPY

AA007 occupant (*n.*) The object or organism that is in a given position or place. —OCCUPATION (*n.*) OCCUPY (*v.*) ↑ PLACE · POSITION

AA008 vacation (*n.*) The action of vacating a place or position, *e.g.* the vacation of Europe by migratory birds when they fly to Africa. ↓ EVACUATION (H), VACATE ↑ PLACE

AA009 evacuation (*n.*) **1** The removal of gas or vapour from a container, *e.g.* the evacuation of a bell jar by a vacuum pump. The focus is on the removal of as much gas or vapour as possible so as to leave a vacuum. **2** The removal of a solid or liquid from an organism. The focus is on the removal of as much material as possible so as to leave nothing behind, *e.g.* the evacuation of the rectum caused by a drug or by a natural process. ↑ PLACE

AA010 boundary (*n.*) A boundary marks, **1** the line dividing one area from another; **2** the surface dividing one volume or one space from another. In contrast to a limit, a boundary can be crossed, *e.g.* there is no distinct boundary between the size of particles in a fine suspension and in a sol □ *the face of a glass block* marks the boundary *between the two optical media* —***bounding*** (*adj.*) BOUND (*v.*) ↓ LIMIT · EXTENT ↑ SPACE[1]

AA011 limit (*n.*) **1** A point, line or surface beyond which it is not possible to go. **2** A value of a quantity or period of time that is the largest or smallest possible value, *e.g.* ***a*** the limit of magnification of an optical microscope is approximately 2000 x; it is not possible to reach a larger value of magnification; ***b*** the limits of human hearing are frequencies of 20 Hz and 20,000 Hz; sound cannot be heard at frequencies below 20 Hz or at frequencies above 20,000 Hz □ *for hearing, 20 Hz is the lower limit of frequency and 20,000 Hz is the upper limit.* Contrast **boundary** and **limit**: when boundary is used the focus may be on either side or on both sides but with limit the focus is on one side only. —LIMIT (*v.*) LIMITED, ***limiting*** (*adj.*) ↑ BOUNDARY

AA012 extent (*n.*) The space between limits, or the time between limits, or the time between events, *e.g.* ***a*** chlorine is used in industry to a greater extent than bromine because it is found naturally in greater abundance (the extent is defined by the limit of the number of reactions for which it can be used); ***b*** the extent of the chemical reaction between nitrogen and hydrogen is determined by the equilibrium mixture

under given conditions (a limit is set by the composition of the equilibrium mixture under the given conditions) □ *pollination takes place to a greater or lesser extent depending upon atmospheric conditions; the extent to which hydrogen and nitrogen react*
↓ RANGE · SPREAD[1] · SCOPE ↑ BOUNDARY

AA013 path (*n.*) An actual or hypothetical line in space along which an object or a radiation may travel, *e.g.* ***a*** the path of a projectile from a gun; ***b*** the path of a ray of light through a glass prism; ***c*** the path of an electron in a magnetic field; ***d*** the path of a planet round the sun. ↓ TRACK[1] (Sn) · COURSE (Sn) ↑ SPACE[1] → DIRECTION

AA014 track[1] (*n.*) The visible evidence left behind along the path of an object, particle, animal, or radiation. A track implies motion of the object, particle or animal making the track. Contrast **trace**, which is discontinuous and does not necessarily imply motion. —TRACK[2] (*v.*) ↓ COURSE (Sn) ↑ PATH (Sn)

AA015 course (*n.*) The path travelled in space and time, *i.e.* the series of changes that take place when anything happens, *e.g.* ***a*** the course of a chemical reaction is the set of changes, *i.e.* the stages by which the reaction proceeds; ***b*** the course of a disease is the set of changes in the condition of the patient □ *during the course of a chemical reaction; in the course of an experiment* ↑ PATH (Sn) · TRACK[1] (Sn)

AA016 range (*n.*) **1** The maximum distance that anything can travel or be ejected, *e.g.* the range of an alpha particle in air is about 7cm (this is the distance it moves before it is stopped); it is the extent of the movement. **2** The area of land over which a plant grows, *e.g.* the range of a date palm is the geographical areas over which it is found; it is the extent of the distribution. **3** The set of values (between two limits) of a quantity for which an event occurs or operates, *e.g.* ***a*** the range of normal human hearing is from 20 Hz to 20 000 Hz; ***b*** the range of temperature most suitable for bacterial growth is 25°C–40°C □ *3 cm is within the range of an alpha particle in air, but 20 cm is out of range; a wide range of readings was taken, not a narrow range; the temperature falls outside the range of the thermometer* ↓ SPREAD[1] · SWEEP[1] · SCOPE ↑ SPACE[1]

AA017 spread[1] (*n.*) **1** A distribution or dispersion of magnitudes about a central or mean value □ *a spread of values resulting from a number of measurements* **2** (G.S.) A thin layer, (the result of spreading). —***spread*** (*v.*) ↑ RANGE · EXTENT

AA018 sweep[1] (*n.*) The extent of the angular motion of an object (similar to the movement of a broom), *e.g.* ***a*** the sweep of a radar beam in a circle; ***b*** the sweep of a telescope through an angle □ *the aeroplane was within the sweep of the radar beam, but the helicopter was outside the sweep.* —SWEEP (*v.*) ↑ RANGE

AA019 scope (*n.*) The extent of a process, plan or study, in operation or in time, determined and limited by an observer, but with free choice within limits, *e.g.* the scope of an experiment is the range of results expected, and may be limited by the time available □ *such results are within the scope of the experiment; such work is outside the scope of the apparatus* ↑ RANGE (Sn) · EXTENT (Sn)

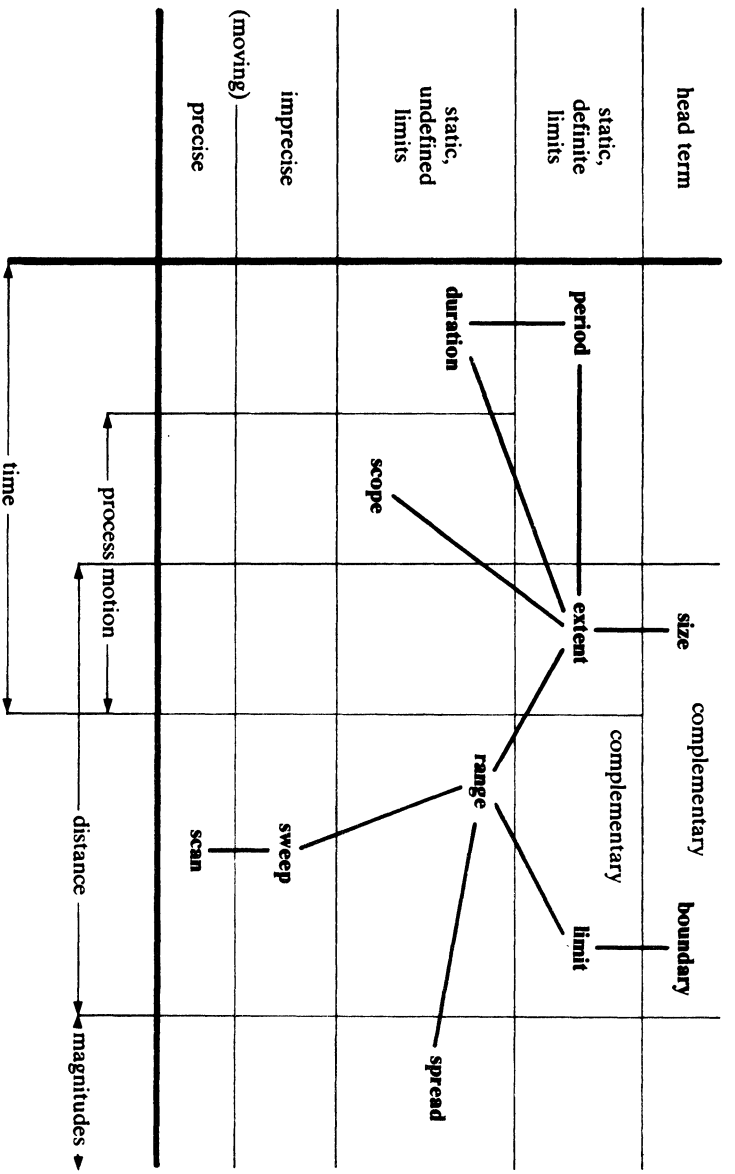
AA020 surface[1] (*n.*) A surface has length and breadth, but no depth, *i.e.* it has only two dimensions. A surface is the outside boundary of a solid, or the upper boundary of a liquid, where the liquid is in contact with the air or with its vapour, *e.g.* the surface of a cube has six faces of equal area.
↓ AREA[1] · REGION[1] · ZONE[1] · VOLUME · PATCH ↑ SPACE[1] → SOLID[1]

AA021 area[1] (*n.*) An extent in two-dimensional space, *i.e.* an extent on a surface, distinguished from its surroundings by observable limits, *e.g.* ***a*** a triangular area is bounded by three straight lines; ***b*** an area bounded by a river on one side and by hills on the other side. Area is measured in metres squared (m^2). ↑ SURFACE[1]

AA022 region[1] (*n.*) An extent on a surface or in three-dimensional space, distinguished from its surroundings by its features, or by conditions operating in it. The extent need not have clearly defined limits, nor a clearly defined shape, *e.g.* ***a*** the ionosphere is a region of the atmosphere where the air is ionized by ultra-violet rays from the sun (a feature) and in which conditions are right for reflecting radio waves; ***b*** a meristematic tissue is a region of growth in plants (a characteristic feature; here three-dimensional space refers to a body). —REGIONAL (*adj.*) ↑ SURFACE[1]

AA023 zone[1] (*n.*) **1** (G.S.) An area, originally with the shape of a band or strip, and still used with this meaning in geographical contexts; it now more often has a focus on features and conditions distinguishing the zone from its surroundings, *e.g.* ***a*** the two polar zones bounded by the arctic and antarctic circles (geographical term with the zone in the shape of a band); ***b*** the date-palm zone of the earth (a zone defined by the conditions which favour the growth of date palms); ***c*** the rain-forest zone of vegetation in tropical countries. **2** (Bio.) A region differentiated from its surroundings by its function and its features. The term is also used as a sub-division of a region, *e.g.* ***a*** the zone of elongation just behind the growing tip of a root or stem (the zone is defined by the function and features of the cells in the zone); ***b*** the savannah region is divided into zones, one of which is the Sudan zone — in this zone, the vegetation has been modified by centuries of habitation (a zone defined by its features). —ZONE (*v.*) ***zoned,*** ZONAL (*adj.*) ↑ SURFACE[1] ↓ ZONE[2]

AA024 volume (*n.*) A measure of the space occupied by a solid or a liquid, or the quantity of substance or material contained in a vessel or container, *e.g.* ***a*** the volume of a cube of metal with sides of 3 cm is 27 cm^3, ***b*** a bottle contains 1 dm^3 of sodium chloride



SIZE & RELATED TERMS

solution; this is the volume of the liquid in the bottle; *c* the vital capacity of a human being is approximately 5 dm^3; this is the volume of air contained in the lungs when fully expanded. ↑ SURFACE[1]

AA025 patch (*n.*) A small, irregular area on a surface, *e.g.* ***a*** a patch of hard skin on a person's foot; ***b*** a bald patch (a patch without hair) on the skin of a cat; ***c*** a patch of light reflected from a mirror onto a wall. ↑ SURFACE[1]

AA026 space[2] (*also* **space out**) (*v.t.*) **1** To arrange objects so that there are spaces between them; to separate by spaces, *e.g.* to space plants in the earth. **2** To arrange events so that they are separated by a space of time, *e.g.* to space out the readings of an experiment so they are taken at 10-minute intervals. ↓ ZONE[2] · TRACK[3] · PLOT ↑ SPACE[1]

AA027 zone[2] (*v.t.*) To limit areas of the ground for particular purposes, mainly in towns, *e.g.* to establish an industrial zone in a town (an area reserved for factories and industries generally); in this case, the conditions which distinguish the zone are made artificially by man. —ZONE (*n.*) ↑ SPACE[2]

AA028 track[3] (*v.t.*) To follow the track of a particle, object or organism, *e.g.* ***a*** to track an animal by following its footprints; ***b*** to track a particle by observing lines of condensation formed in a bubble chamber. —TRACK (*n.*) ↑ SPACE[2]

AA029 plot (*v.t.*) **1** To record the track of a particle or an object, *e.g.* to follow the track of a rocket by observations made with instruments and to record the track on a plan or map. **2** To calculate points on the path to be followed by an object and to record those points, *e.g.* ***a*** to plot the course to be followed by a ship from one port to another port by marking points on a map; ***b*** to plot points on graph paper after calculating the position of the points. —***plot*** (*n.*) ↑ SPACE[2]

AA030 occupy (*v.t.*) To be in a particular position or place. The focus is on the object or organism and not on the position, *e.g.* ***a*** an electron occupies an orbital; ***b*** a cotyledon occupies a position on a seedling above the root. —OCCUPANT, OCCUPATION (*n.*) ***occupied*** (*adj.*) ↓ VACATE (Cn) · EXHAUST[1] · EVACUATE · DISLOCATE · ESTABLISH ↑ SPACE[1]

AA031 vacate (*v.t.*) To leave empty; to go away from, *e.g.* some birds vacate their nests when their young are old enough to fly. The focus is on the process of leaving. ↑ OCCUPY (Cn)

AA032 exhaust[1] (*v.t.*) **1** To remove gas from a vessel or from an engine. The focus is on the gas being removed, *e.g.* a vacuum is created by exhausting air from a container. **2** To consume completely, *e.g.* the birds died because their food supply was exhausted, *i.e.* they had no more food to eat. —EXHAUST (*n.*) ↓ EVACUATE ↑ OCCUPY

AA033 evacuate (*v.t.*) **1** (G.S.) To remove the contents or occupants from a space which they usually occupy, *e.g.* the animals were evacuated from the game park (leaving the game park empty). **2** (Ch.,Ph.) To remove a gas from a vessel leaving behind more empty space. The focus is on the space left behind, *e.g.* air is evacuated from a flask (tending to leave a vacuum). Compare **exhaust** and **evacuate:** the flask is evacuated using a pump and in the process the air is exhausted from the flask. —***evacuation*** (*n.*) ↑ OCCUPY

AA034 dislocate (*v.t.*) To cause a part of a structure to move out of position by the application of stress, *e.g.* ***a*** to dislocate a joint out of its socket; ***b*** to dislocate a crystal by causing it to shear (moving some of the atoms out of position). —***dislocation*** (*n.*) ***dislocated*** (*adj.*) ↑ OCCUPY

AA035 establish (*v.t.*) **1** (Of organisms) to make a place a permanent home for oneself, *e.g.* when plants establish themselves in a place they can grow there permanently and reproduce. **2** To make strong, secure or permanent, *e.g.* plants establish strong roots if the conditions are right. **3** To make a theory or hypothesis accepted, *e.g.* the existence of the electron has been established beyond all doubt (nobody believes that electrons do not exist). —***establishment*** (*n.*) ↑ OCCUPY → PERPETUAL

AA036 extensive (*adj.*) Covering a wide area, *e.g.* ***a*** the distribution of the earthworm is extensive: it can be found throughout the world; ***b*** in the nineteenth century there was extensive use of opium as a household medicine. —***extensively*** (*adv.*) ↓ VOLUMINOUS ↑ SPACE[1] → EXTENDED · INTENSIVE (Ag)

AA037 voluminous (*adj.*) Having large volume, *e.g.* the action of concentrated sulphuric acid on sugar produces heat, steam and a voluminous mass of carbon (the carbon has a large volume for its mass). —***volume*** (*n.*) ***voluminously*** (*adv.*) ↑ EXTENSIVE

AA038 spatial (*adj.*) Describes an arrangement in space, or the extent in space. —SPACE (*n.*) SPACE (*v.*) ***spatially*** (*adv.*) ↓ REGULAR[1] · MARGINAL ↑ SPACE[1]

AA039 regular[1] (*adj.*) Describes objects separated by equal differences in space, or occurrences with equal differences in time, *e.g.* ***a*** telegraph poles at regular intervals; ***b*** a telephone ringing at regular intervals. ↑ SPATIAL

AA040 marginal (*adj.*) **1** Describes the narrow area round the edge of a flat surface, *e.g.* the marginal part of a leaf comprises the actual edge and a narrow band inside the edge; this part is the leaf margin. **2** Describes conditions reaching a limit or a boundary, *e.g.* a marginal environment for a plant species consists of land and other factors such that the species might just survive, *i.e.* the conditions are on the boundary between adverse and suitable. —***margin*** (*n.*) ↑ SPATIAL

AA041 surroundings (*n.pl.*) All the objects which may act on a system. See ENVIRONMENT[1]. ↓ ENVIRONMENT[1] · SITUATION

· POLLUTION[2] · LOCATE · SINGLE ↑ SPACE[1] → THERMODYNAMICS

AA042 environment[1] (*n.*) The active items of the surroundings of an organism that affect the organism. Factors in the environment include temperature, humidity, the presence of other organisms and the presence of physical objects; all these can have an effect on the behaviour and existence of the organism. Contrast **surroundings** which may or may not affect the organism, *e.g.* a tree is part of the surroundings of an animal if it has no effect on the animal's life. If it provides food, shade or shelter, it is part of the animal's environment. —***environmental*** (*adj.*) ↓ CIRCUMSTANCES (Sn) · ISOLATION ↑ SURROUNDINGS (Sn)

AA043 circumstances (*n.pl.*) Those items which make up the total environment of an object, substance or organism, and which may or may not have an effect on a process in which the object, substance or organism is involved. Contrast **conditions**, which are those items of circumstances that have an effect on a process in which the object, substance or organism is involved □ *certain actions take place under specific circumstances; in the circumstances prevailing at the time* —***circumstantial*** (*adj.*) ↑ ENVIRONMENT[1] → CONDITIONS (H)

AA044 isolation (*n.*) **1** A process by which an individual or an object can be placed alone and apart from its usual environment, *e.g.* ***a*** the isolation of an infectious person (away from other people); ***b*** the isolation of an induced positive charge (away from the negative charge). **2** The state in which an individual or object is placed apart, *e.g.* an infectious person is put in isolation □ *an object is placed in isolation* —***isolate*** (*v.*) ***isolating,*** ISOLATED (*adj.*) ↑ ENVIRONMENT[1] → ISOLATE

AA045 situation (*n.*) **1** A part of space or a spot in space occupied by an object, organism or structure. A situation is a place or position and is known by its surroundings, *e.g.* the situation of the centrosome of a cell is close to the nucleus. **2** The combination of circumstances at a given place and time, *e.g.* in Dalton's time the situation was that people thought that atoms were small indestructible particles. —***situate*** (*v.*) ***situated*** (*adj.*) ↓ LOCATION[1] (Sn) · SITE[1] (Sn) ↑ SURROUNDINGS

AA046 location[1] (*n.*) **1** A place; a part of space or point in space where objects, organisms, fields or events may be found, *e.g.* the location of the cleavage planes in a crystal may be found by splitting the crystal. **2** The act or process of finding the position of an object, organism, field or event. The focus is on the place and not on the surroundings. —LOCATE (*v.*) ***located*** (*adj.*) ↓ SITE[1] (Sn) ↑ SITUATION (Sn) → LOCATE

AA047 site[1] (*n.*) A fixed position where an object, structure or tissue is placed or where something happens, *e.g.* ***a*** bone marrow is the site where red blood cells form; ***b*** adsorption of gas occurs at definite sites on the surface of a solid (gas molecules are held on atoms of the solid). The focus is on what occupies the site and not on the location or the situation. —SITE (*v.*) ***sited*** (*adj.*) ↑ SITUATION (Sn) · LOCATION[1] (Sn)

AA048 pollution[2] (*n.*) The process of making an environment unhealthy or impure, *e.g.* waste gases from factory chimneys may cause pollution in the air. —***pollute*** (*v.*) ***polluted*** (*adj.*) ↑ ENVIRONMENT[1]

AA049 locate (*v.t.*) To search for, and find, a position or an object, *e.g.* ***a*** to locate the connecting screws in their holes (finding a position): ***b*** to locate a source of infection in the body (finding a stated object). ↓ SITE[2] ↑ SURROUNDINGS

AA050 site[2] (*v.t.*) To put something in an appropriate or suitable situation, especially something large, such as a house, factory, machine. ↑ LOCATE

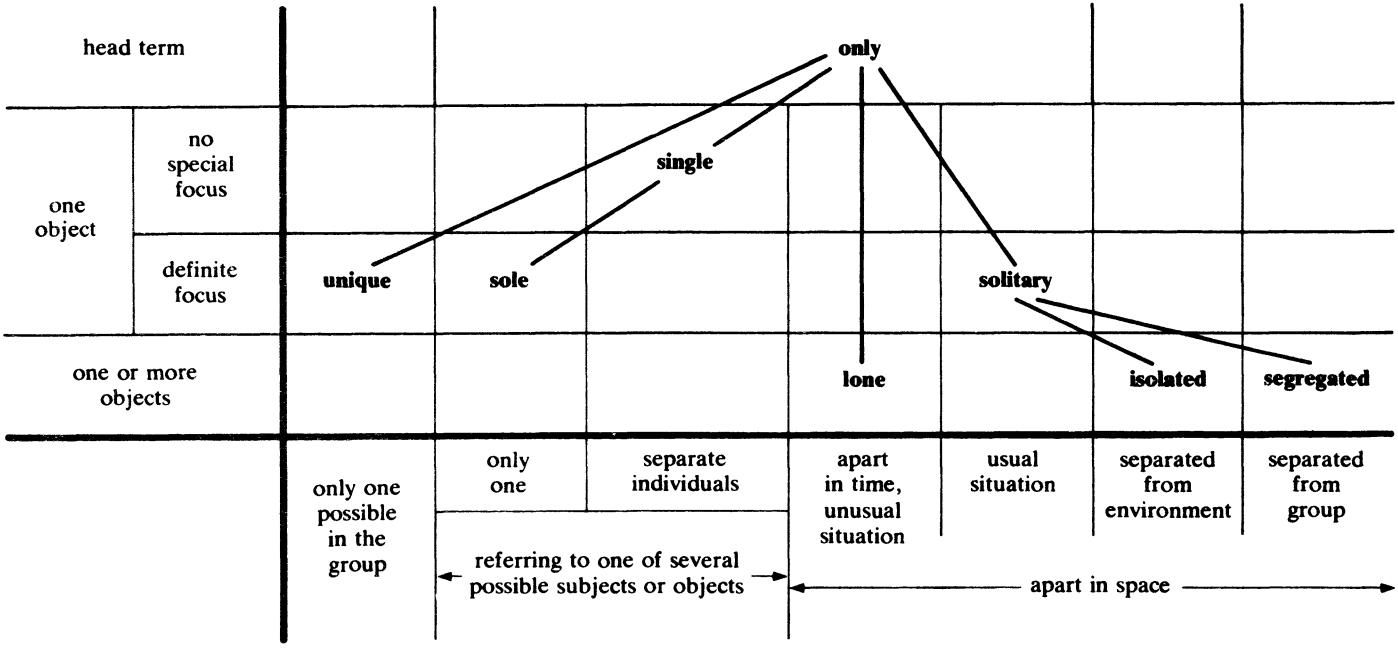
AA051 single (*adj.*) Describes one object, organism, action or process which is separate from others, *e.g.* ***a*** separate experiments are carried out on photosynthesis, each single experiment determines one condition for photosynthesis to take place. Note that several objects, etc., can be described as single, and each one is considered separately; it does not exclude other single objects from a group, which may also be considered. —***singly*** (*adv.*) ↓ SOLE[1] (Sn) · SOLITARY (Sn) · LONE (Sn) · ISOLATED · SEGREGATED · UNIQUE ↑ SURROUNDINGS → PARTICULAR

AA052 sole[1] (*adj.*) Describes one object, organism or unit, which is separate from others. The focus is on one, and excludes all others in the group, *e.g.* he was the sole survivor from the accident (the others could have survived, but only one survived). —***solely*** (*adv.*) ↓ SOLITARY (Sn) ↑ SINGLE

AA053 solitary (*adj.*) (Of organisms) living or existing alone and apart from others of the same kind. For animals the term describes the usual behaviour of the species, *e.g.* the mason wasp is a solitary insect (it lives by itself and does not form a community as do some other wasps). ↓ LONE ↑ SINGLE

AA054 lone (*adj.*) Describes objects or organisms that are apart in space, configuration or time, *i.e.* that are found or live apart from others of the same kind, *e.g.* a lone pair of electrons is a pair of electrons apart from other electrons in the electron shell as they are not taking part in a bond. For animals the term describes an animal by itself, but usually found in a herd, *e.g.* a lone wolf is one living alone, having left the pack. Compare **solitary** in which there is no community for the organism to live with. ↑ SINGLE · SOLITARY (Sn)

AA055 isolated (*adj.*) Separated or kept apart from others of the same kind or from the usual or natural environment, *e.g.* an isolated sample of pure octane (a sample separated from a mixture with other hydrocarbons). —ISOLATION (*n.*) ISOLATE (*v.*) ↓ SEGREGATED (Sn) ↑ SINGLE



ONLY & RELATED TERMS

AA056 segregated (*adj.*) Separated from a main group of objects or organisms by a deliberate action, *e.g.* a segregated group of infected guinea pigs (separated from the main collection to avoid infection). —***segregation*** (*n.*) ***segregate*** (*v.*) ↑ SINGLE · ISOLATED (Sn)

AA057 unique (*adj.*) Being the only one of its kind, *e.g.* ***a*** when a mathematical equation has one solution, and only one solution is possible, the solution is unique; ***b*** mercury is unique in being the only metallic element that is liquid at room temperature. —***uniquely*** (*adv.*) ↑ SINGLE

AA058 join[1] (*v.t.,i.*) **1** (*v.t.*) To put two or more things together and make them into one different thing, *e.g.* ***a*** four hydrogen atoms are joined (by 4 covalent bonds) to one carbon atom to make a methane molecule; ***b*** very many potassium ions and chloride ions are joined to form an ionic potassium chloride crystal; ***c*** two pieces of iron can be joined together by welding; ***d*** several pieces of string can be joined by tieing to form one longer piece of string □ *to join objects together.* **2** (*v.i.*) To be joined together; to come together and form one, *e.g.* carbon and hydrogen atoms join together to form molecules —JOIN, JOINT, JUNCTION (*n.*) JOINED (*adj.*) ↓ JUNCTION · COMBINATION · CLUSTER · UNITE · MERGE · CONNECTIVE[1] ↑ SPACE[1]

AA059 junction (*n.*) A point or place where two or more objects or structures are joined together, *e.g.* ***a*** two roads meet at a junction; ***b*** the point at which two blood vessels meet, or from which they depart, is a junction; ***c*** two wires of different metals joined at one end form a junction of a thermocouple. ↓ CONFLUENCE · JOINT[1] · JOIN[2] · BOND · CONNECTION · INCLINATION[1] ↑ JOIN[1]

AA060 confluence (*n.*) The junction of two channels at which fluids meet and flow onwards together, *e.g.* ***a*** the confluence of the caval veins occurs at the right atrium; ***b*** the confluence of two rivers (the place where one joins the other). —CONFLUENT (*adj.*) ↑ JUNCTION

AA061 joint[1] (*n.*) The point at which two or more objects are joined. The joint can be fixed, in which case the objects are immovable relative to one another, or the joint can be movable, in which case the objects move relative to one another. A joint is a structure in which the parts are discontinuous, *e.g.* ***a*** two pieces of wood are fixed together by a joint; ***b*** two parts of a limb are joined at a movable joint. —***jointed*** (*adj.*) ↑ JUNCTION

AA062 join[2] (*n.*) The place at which two objects are joined together, *e.g.* the mark or line which is the visible indication that two objects are joined together. —JOIN (*v.*) ↑ JUNCTION

AA063 bond (*n.*) A substance or structure which fixes two objects firmly together. A bond forms a continuous solid structure, *e.g.* an adhesive between two pieces of wood forms a bond between them □ *to form a bond between two objects* —***bond*** (*v.*) ***bonded*** (*adj.*) ↑ JUNCTION → CHEMICAL BOND

AA064 connection (*n.*) A physical object which joins two or more other objects, *e.g.* a piece of wire joining two resistors is a connection. **2** A link between physical quantities, facts, statements, concepts or propositions, *e.g.* ***a*** there is a connection between mass and volume for any pure substance; ***b*** there is no connection between the size of a man's foot and the colour of his eyes; ***c*** there is a connection between the blood group of a child and the blood group of his parents □ *a loose connection in the circuit; a connection between the components; to make a connection between parts* —***connected,*** CONNECTIVE (*adj.*) ↑ JUNCTION → CONNECT[1]

AA065 inclination[1] (*n.*) The angle at which two lines, or two planes, meet; the angle which a slope makes with a vertical or a horizontal line. —***incline*** (*n.*) ***incline*** (*v.*) ***inclined*** (*adj.*) ↑ JUNCTION

AA066 combination (*n.*) The act or process in which substances, objects, effects or properties are joined together or act together, *e.g.* ***a*** sodium and chlorine form sodium chloride by chemical combination (joining together to form a new substance with different properties); combination of resistors in series (joining in a line) produces a total resistance equal to the sum of the resistances joined; ***c*** the combination of forces acting on a body gives a resultant force (the forces act together); ***d*** aluminium alloys show a combination of strength with lightness (both properties are present in the alloy, *i.e.* they act together). —***combine*** (*v.*) ↓ UNIFICATION · UNION ↑ JOIN[1]

AA067 unification (*n.*) The formation of a stable unit by joining parts or components together for the purpose of a definite function, *e.g.* the principles of the conservation of mass and of the conservation of energy underwent unification in Einstein's postulate of the equivalence of mass and energy. —***unify*** (*v.*) ***unified*** (*adj.*) ↑ COMBINATION

AA068 union (*n.*) **1** The part, component or structure used to unify a system, *e.g.* a piece of tubing which connects two hydraulic systems to unify them into one system is a union. **2** The act or process of unification, *e.g.* the union of gametes to form a zygote, a new individual. ↑ COMBINATION

AA069 cluster (*n.*) A group of objects connected together either in fact, or abstractly, *e.g.* ***a*** a cluster of flowers as in an umbel; ***b*** a cluster of terms, connected in meaning. —***cluster*** (*v.*) ↓ BUNCH[1] · CLUMP[3] · COLLECTION ↑ JOIN[1] → UMBEL

AA070 bunch[1] (*n.*) A group of similar objects either collected together or coming together because of external conditions, *e.g.* ***a*** a bunch of flowers has been picked and collected; ***b*** electrons in a klystron are brought together in a bunch. —***buncher*** (*n.*) ***bunch*** (*v.*) ↑ CLUSTER → KLYSTRON

AA071 clump[3] (*n.*) A small group of trees

or herbs growing in the ground very closely together, so that they form a dense mass of vegetation. ↑ CLUSTER

AA072 collection (*n.*) A group of objects which have been brought together; the term implies that each item is of importance, and may be kept and labelled separately. —***collect*** (*v.*) ↑ CLUSTER · BUNCH[1] (H)

AA073 unite (*v.t.,i.*) **1** (*v.i.*) To become one unit; to join together to become one, *e.g.* ions of opposite charge unite to form an ionic crystal. **2** (*v.i.*) To act together, *e.g.* the defences of the body unite to overcome the attack of bacteria. **3** (*v.t.*) To cause to unite. —***unity*** (*n.*) ↓ BLEND · COUPLE[1] ↑ JOIN[1]

AA074 blend (*v.t.*) To mix varieties of the same substance or similar forms of energy to produce a homogeneous whole which retains some or all of the properties of the original, *e.g.* the brain blends together the coloured images on a Newton disc when it is rapidly rotated, finally producing a white image —***blend*** (*n.*) □ *to blend two substances together.* ↑ UNITE

AA075 couple[1] (*v.t.*) To join two objects or structures together or to link two systems so that they affect each other, *e.g.* ***a*** to couple two railway carriages (join two objects); ***b*** to couple two electrical circuits through a transformer (the primary and secondary coils are not directly connected, but the magnetic field produced in one coil induces a current in the other). ↑ UNITE → INTERCONNECT

AA076 merge (*v.t.,i.*) **1** (*v.i.*) To come together with a gradual change in pattern so that individual objects and organisms cannot be easily distinguished, *e.g.* ***a*** the markings on a zebra or tiger allow it to merge into the background (it is difficult to see it against the background); ***b*** the lines in the spectrum of a molecule may merge to form a continuous band (the lines are so close together that individual lines cannot be seen; instead they appear as a continuous band) □ *lines merge together; a zebra merges into the background* **2** (*v.t.*) To cause to merge. ↓ COALESCE · BUNCH[2] ↑ JOIN[1]

AA077 coalesce (*v.i.*) To grow together to become one entity, *e.g.* small drops of liquid may coalesce to form larger drops. —***coalescence*** (*n.*) ↑ MERGE

AA078 bunch[2] (*v.t.,i.*) To bring together, or to come together, to form a bunch. ↑ MERGE

AA079 connective[1] (*adj.*) Describes that which connects two objects or structures, *e.g.* connective tissue connects two other tissues. ↓ INTERCONNECTED · ADJACENT · BOUND[1] ↑ JOIN[1]

AA080 interconnected (*adj.*) Describes two systems which are connected together, *e.g.* the various systems of the body (digestive, nervous, circulatory) are interconnected. The focus is on the mutual relation of the functions of the systems. ↑ CONNECTIVE[1]

AA081 adjacent (*adj.*) (Of two objects) side by side, touching, or near together with nothing between them, *e.g.* ***a*** violet and indigo are adjacent colours in the visible spectrum; ***b*** adjacent angles are angles with a line or plane in common and a common vertex; ***c*** adjacent faces of a solid are faces that come together at a common side. ↑ CONNECTIVE[1]

AA082 bound[1] (*adj.*) Describes two objects which are firmly held together by a structure, *e.g.* a sodium ion and a chlorine ion are bound together in a crystal of sodium chloride by an ionic bond. ↑ CONNECTIVE[1] → CHEMICAL BOND · FREE (An)

AA083 crack (*n.*) A narrow, shallow opening on the surface of an object or tissue. A crack is formed in a fragile or brittle object by a blow; it is formed in a tissue by dryness or by shrinking; it is produced on a surface by uneven tensions. —***crack*** (*v.*) ***cracked*** (*adj.*) ↓ FISSURE · CREVICE · CLEFT ↑ SPACE[1] → SEPARATION · FRACTURE · FAULT

AA084 fissure (*n.*) **1** An opening which is deeper than a crack and occurs in a natural structure. The focus is on the depth of the fissure from the surface, *e.g.* ***a*** fissures on the lip which develop from cracks; ***b*** a fissure in rock. **2** An opening which may divide a structure into two portions, *e.g.* the fissure between the lobes of the brain (in this case it is a normal structure). ↑ CRACK

AA085 crevice (*n.*) A long broad crack, usually in the face of a cliff. A crevice is large enough for soil to gather and plants to root in the soil. ↑ CRACK

AA086 cleft (*n.*) An opening which is both wider and deeper than a crack and may occur in a natural structure, so that the structure is divided into two portions, *e.g.* a cleft in a rock. In biological terms, a cleft can imply an abnormal structure, *e.g.* a cleft in a palate. ↑ CRACK

Matter

AB001 matter (*n.*) That which occupies space at any given time and is observable or detectable, *e.g.* any object or any material or any organism is composed of matter; all substances, compounds and elements are matter. Matter has a structure; different types of matter have different structures but all matter is considered to be composed of discrete particles (atoms). The quantity of matter may be measured by its mass or its volume or its amount of substance □ *gas, liquid and solid are all states of matter* —MATERIAL (*adj.*) ↓ MATERIAL[1] · ENTITY · IMPURITY · CRUMBLE · CONSIST OF · NATURAL · COARSE[1] · MOBILE · FORM[3] · CONSISTENCY[2] · POUND · POROUS[1] · FRIABLE · PROPERTY → SPACE[1]

AB002 material[1] (*n.*) A material is any type of matter that can be named. A material has properties, by which it can be recognized, but which are variable, *e.g.* ***a*** wood is a material with distinctive properties yet all the properties of different types of wood are not the same; ***b*** leather is a material and can be either soft or hard. To contrast **substance** with material: a substance has a definite chemical composition, although the composition may be too complex to record with ease (*e.g.* DNA), and fixed properties, but a material has a chemical composition and properties which are variable within limits. —MATERIAL (*adj.*) ↓ SUBSTANCE (Sn) · ELEMENT[1] · SOLID[1] · FLUID[1] · LIQUID[1] · GAS[1] ↑ MATTER

AB003 substance (*n.*) A substance is any type of matter that can be named. A substance has properties that can be described, so that the substance can be identified, *e.g.* iron, salt and haemoglobin are all substances □ *a named substance; a known substance; an unknown substance* ↑ MATERIAL[1] (Sn) → CHEMICAL · COMPOUND

AB004 element[1] (*n.*) A basic constituent of a chemical compound or a basic component of a branch of study, *e.g.* the elements of arithmetic set out the basic rules and operations used in arithmetic. —ELEMENTARY (*adj.*) ↑ MATERIAL[1] → ELEMENT[2]

AB005 solid[1] (*n.*) Matter with a definitive volume and shape. The solid state is one of the states of matter, *e.g.* ice, glass, and coal are all solids. The structure of a solid is determined by the arrangement in space of its molecules, atoms or ions, which cannot move freely but vibrate about a fixed position. Solids are either crystalline solids or amorphous solids (including glasses and polymers). —***solid*** (*adj.*) SOLIDIFY (*v.*) ↑ MATERIAL[1] → CRYSTAL · GLASS · POLYMER

AB006 fluid[1] (*n.*) Matter that does not have a fixed shape. Both a liquid and a gas are fluids. The essential property of a fluid is its ability to flow along a channel or a tube. In biology and in general speech, the term fluid is often used to mean liquid only —FLUID (*adj.*) ↑ MATERIAL[1]

AB007 liquid[1] (*n.*) Matter with a definite volume but no definite shape. The liquid state is one of the states of matter, *e.g.* water and mercury at room temperature are liquids. In this state a substance takes on the shape of the containing vessel. It is distinguished from a gas by not expanding to fill the containing vessel, *i.e.* it retains its own volume at any given temperature. —***liquefy*** (*v.*) ***liquefaction*** (*n.*) ↑ MATERIAL[1] → LIQUEFACTION

AB008 gas[1] (*n.*) Matter with neither definite volume nor definite shape. The gaseous state is one of the states of matter, *e.g.* hydrogen and oxygen at room temperature are gases. In this state, a substance expands to fill the containing vessel. An amount of gas has a fixed mass, but no fixed volume; the volume changes with temperature and pressure. —***gaseous*** (*adj.*) ↑ MATERIAL[1] → VAPOUR

AB009 entity (*n.*) A piece or a particle of matter existing complete in itself, independently of the existence of all other matter, *e.g.* the nucleus of an atom was once thought to contain electrons which neutralized some of the protons. Chadwick proved the existence of the neutron as a separate entity, *i.e.* the neutron existed complete in itself independently of the existence of other atomic particles. The entity of the neutron is its real existence. ↓ BODY[1] · RIGID BODY · ELASTIC BODY · BODY[2] · PARTICLE · FRAGMENT · CRUMB · GRAIN · GRANULE ↑ MATTER → IDENTITY · EXISTENCE

AB010 body[1] (*n.*) A single piece of matter used as a suitable reference for discussion. It is often not necessary to state any of the dimensions of the body or to state the mass or composition of the body, *e.g.* when a force acts on a body it changes the momentum of the body □ *a moving body; a falling body; a body at rest* ↓ PARTICLE (H) ↑ ENTITY

AB011 rigid body (*n.*) A body, the shape and size of which are not perceptibly changed by any force applied to the body. All real bodies are deformed or distorted slightly by any force ↑ ENTITY

AB012 elastic body (*n.*) A body that changes its shape and size when a force is applied and then returns to the original shape and size when the force is no longer applied. ↑ ENTITY

AB013 body[2] (*n.*) The main part of an animal excluding its appendages, such as arms, legs and head; the whole of an animal which has no appendages; the main stem of a plant. The term is not exact. Body is used to describe the whole material organism, especially for the human body, but it is also used to describe all parts of the organism excluding the head. ↑ ENTITY → TRUNK · APPENDAGES

AB014 particle (*n.*) **1** (G.S.) A very small piece of matter. **2** (Ph.) A piece of matter

that is assumed to have mass but is so small it is assumed not to have dimensions, *i.e.* it is considered to be a point. ↑ ENTITY → FUNDAMENTAL[1]

AB015 fragment (*n.*) A piece broken off from a whole; an incomplete or an isolated part of a whole. —***fragmentation*** (*n.*) FRAGMENT (*v.*) ***fragmented*** (*adj.*) ↑ ENTITY

AB016 crumb (*n.*) A particle or a small fragment such as breaks off by rubbing. —CRUMBLE (*v.*) ***crumbling, crumbly*** (*adj.*) ↑ ENTITY

AB017 grain (*n.*) **1** A minute, hard particle of matter, as in grains of sand or grains of salt. **2** A seed of a cereal. —***granulate*** (*v.*) GRANULAR (*adj.*) ↑ ENTITY · PARTICLE (Sn)

AB018 granule (*n.*) **1** A small piece of matter made up of a number of grains held together. Granules resemble particles in a very coarse powder, so coarse that it can no longer be called a powder. A substance composed of such granules is between a powder and an aggregate. **2** A small grain, *e.g.* the cytoplasm of animal cells often appears to contain microscopic particles referred to as granules. These particles are much smaller than other particles that are visible and referred to as grains. —GRANULAR (*adj.*) ↑ ENTITY

AB019 impurity (*n.*) A small amount of substance present in another substance, *e.g.* silver is a common impurity in unrefined lead. —IMPURE (*adj.*) ↑ MATTER → IMPURE

AB020 crumble (*v.t.,i.*) **1** (*v.t.*) To break a solid into crumbs by pressure and rubbing. **2** (*v.i.*) (Of a solid) to become broken into crumbs; to fall into small pieces. ↓ DISINTEGRATE · PERISH ↑ MATTER → CRUMB

AB021 disintegrate (*v.i.*) (Of materials) to cease to be a recognisable whole, *i.e.* to lose form by breaking up into small pieces, *e.g.* ***a*** during testing, a small sample of concrete disintegrates under pressure and breaks into small pieces; ***b*** a piece of cotton cloth, when soaked in acid, quickly disintegrates into small pieces. —***disintegration*** (*n.*) ↑ CRUMBLE

AB022 perish (*v.i.*) (Of a material) to lose its distinctive properties making it no longer of use, *e.g.* ***a*** rubber perishes on heating or with age, losing its elasticity and no longer of use; ***b*** canvas perishes with exposure to rain, air and sunlight. The focus is on the loss of distinctive properties. —PERISHABLE (*adj.*) ↑ CRUMBLE → DURABLE (I)

AB023 consist of (*v.i.*) To be made up of, with all the constituents named, *e.g.* water consists of hydrogen and oxygen. ↓ CONTAIN ↑ MATTER

AB024 contain (*v.t.*) **1** (Of a vessel) to hold a substance, or to hold a certain amount of substance, *e.g.* the beaker contains three grams of sulphur. **2** (Of a mixture) to possess certain substances, *e.g.* milk contains fat and sugar. Contrast **consist of** and **contain:** gunpowder consists of sulphur, charcoal and nitre (only these substances are used in gunpowder); gunpowder contains sulphur, *i.e.* only some of the constituents are named. —***container*** (*n.*) ↑ CONSIST OF → COMPOSED OF · CONSTITUENT

AB025 natural (*adj.*) Describes substances existing in nature, substances produced by nature, or processes taking place without human action, *e.g.* ***a*** natural gas which exists in pockets in the earth; ***b*** natural science is all sciences concerned with the physical world; ***c*** natural frequency is the frequency of vibration of a body when it is not affected by outside sources; ***d*** natural radioactivity is the radioactivity from naturally occurring substances □ *natural gas is a naturally occurring substance* —***naturally*** (*adv.*) ↓ ARTIFICIAL (I) · IMITATION · FREE · DISCRETE · AVAILABLE[2] · MATERIAL[2] · COMPOSED OF · IMPURE ↑ MATTER → SYNTHETIC

AB026 artificial (*adj.*) Describes a substance, material or object made by man to take the place of one which is found in nature. The chemical composition is usually not the same, *e.g.* artificial radioactive substances; artificial diamonds; artificial silk □ *nylon is an artificial fibre* —***artificially*** (*adv.*) ↑ NATURAL (I) → SYNTHETIC

AB027 imitation (*adj.*) Describes a material or substance which is like a real material or substance in appearance, but is made from a different material or substance, *e.g.* imitation leather is usually made from a plastic substance. Contrast **artificial** and **imitation:** artificial diamonds have been manufactured (as opposed to natural diamonds) and have the properties of diamonds, but not necessarily their appearance, while imitation diamonds have the appearance of diamonds but not necessarily the properties of natural diamonds. —***imitate*** (*v.*) ***imitation*** (*n.*) ***imitative*** (*adj.*) ↑ NATURAL

AB028 free (*adj.*) **1** Describes the state of a particle or an object that is not tied or bound by force (universal forces, such as gravity, excluded). The term describes a comparative state, as it is impossible in the physical world to have no forces acting, *e.g.* ***a*** an ion in a crystal of sodium chloride is bound by strong forces, but an ion in a solution of sodium chloride is free, and can move when a potential difference is applied to the solution. (The ion in solution is a free ion; the force of gravity and the attractive forces of other ions still act on it, but compared with an ion in the crystal, the ion in the solution is free to move). ***b*** Electrons in a solid metal are free (no one electron is bound to any particular metal nucleus; the electrons move when a potential difference is applied to the metal). **2** Describes an element that is not combined in a compound, *e.g.* free sulphur is the element sulphur; the sulphur in sulphuric acid (H_2SO_4) is not free but is combined with other elements. **3** (Of animate objects) being able to move, or act, under their own volition. This also describes a comparative state, as social instincts and enemies prevent the animal from being able to act solely under its own volition. —***freedom*** (*n.*) FREE, SET FREE (*v.*) ↑ NAT

URAL → BOUND (An)

AB029 discrete (*adj.*) Describes matter or energy that occurs in individual units which cannot be further divided, *e.g.* ***a*** Planck stated that energy does not flow continuously from hot bodies but comes off in quanta, *i.e.* energy is discrete and not continuous (the unit is the quantum, and it cannot be subdivided); ***b*** the charge on an electron is $1{\cdot}6 \times 10^{-19}$ coulomb; this charge is discrete and cannot be further divided; ***c*** a gas is composed of discrete molecules or atoms. ↑ NATURAL → DIVERGENT · SEPARATE · CONTINUOUS (An)

AB030 available[2] (*adj.*) Describes anything that can be used if required, *e.g.* ***a*** bleaching powder will set free chlorine which can be used for bleaching or sterilizing; only part of the chlorine in bleaching powder can be set free; this is the available chlorine; ***b*** water is available from a piped supply. ↑ NATURAL

AB031 material[2] (*adj.*) Of, to do with, or consisting of matter, *e.g.* ***a*** air is a material medium for sound waves, *i.e.* the medium consists of a substance, air, which is matter, since it has mass and occupies space; ***b*** a material object occupies space. —MATERIAL (*n.*) ↑ NATURAL

AB032 composed of (*adj.*) Made up of, either with the parts chemically combined, mixed, or put in a definite arrangement. ↑ NATURAL → COMPOSITION

AB033 impure (*adj.*) The opposite of **pure.** Describes a substance containing small amounts of other substances (impurities), *e.g.* ***a*** the copper extracted from ore is impure and must be refined; ***b*** ethyl ethanoate (ethyl acetate) formed during the usual preparation is impure and must be purified. —***impurity*** (*n.*) ↑ NATURAL → PURE (I) · REFINED (I)

AB034 coarse[1] (*adj.*) **1** Describes particles that are large and rough or a powder made up of large, rough particles. **2** Describes threads, filaments, etc., that have a fairly large diameter and a rough surface, *e.g.* ***a*** the coarse hair that covers the bodies of animals; ***b*** string is coarser than thread. —***coarseness*** (*n.*) ***coarsely*** (*adv.*) ↓ FINE[1] (An) · GRANULAR · GRANULATED ↑ MATTER

AB035 fine[1] (*adj.*) **1** Describes particles that are small or a powder made up of small particles. **2** Describes threads, filaments, etc., that have fairly small diameter and a smooth surface, *e.g.* ***a*** the threads of a spider's web are very fine; ***b*** a diffraction grating is ruled with many fine lines (about 500 per mm). —***fineness*** (*n.*) REFINE (*v.*) ↑ COARSE[1] (An)

AB036 granular (*adj.*) Consisting of grains or granules, *i.e.* descriptive of a coarse powder; a surface or structure which appears as if composed of grains, *e.g.* ***a*** the endoplasm of certain animal cells is granular in appearance, *i.e.* it appears to contain many granules (descriptive of a structure); ***b*** the scar tissue in a wound is not smooth, but consists of many small prominences; it is described as granular tissue (descriptive of a surface). —***granule*** (*n.*) ↑ COARSE[1]

AB037 granulated (*adj.*) **1** Formed from grains, *e.g.* granulated sugar. **2** Having a rough surface in which grains or granules can be seen, *e.g.* granulated zinc. ↑ COARSE[1]

AB038 mobile[4] (*adj.*) Capable of easy movement. Mobile liquids are liquids that flow easily, *e.g.* water is mobile in contrast with treacle, which is **viscous** □ *the mobile phase* —***mobility*** (*adj.*) ↓ PERISHABLE ↑ MATTER → VISCOUS (An)

AB039 perishable (*adj.*) Describes natural substances which have the disposition to lose their natural properties or to decay, *e.g.* ***a*** natural rubber is perishable as long use causes it to lose its property of elasticity; ***b*** fish is readily perishable as, if it is left at room temperature, it soon putrefies. —PERISH (*v.*) ***perished*** (*adj.*) ↑ MOBILE[4]

AB040 form[3] (*n.*) A particular physical state of a substance. The form of a substance may be its state of matter (solid, liquid or gas), its crystal structure, or its state of aggregation, *e.g.* ***a*** ammonia gas, liquid ammonia and aqueous ammonia are three forms of the compound; ***b*** zinc metal can be obtained in granulated form or in powder form. The difference between **form**[2] and **form**[3] should be noted, *i.e.* form[3] is not a generalization of shape or property or structure; it is a general description of the physical appearance. ↓ AGGREGATE[2] · POWDER[1] · PASTE · FOIL ↑ MATTER → FORM[2]

AB041 aggregate[2] (*n.*) A heterogeneous mass of parts or particles; the term implies the formation of a whole without an intimate mixing of constituents. —***aggregate*** (*v.*) ***aggregative*** (*adj.*) ↑ FORM[3]

AB042 powder[1] (*n.*) A mass of dry, solid particles, so fine that they cannot be felt individually when the powder is rubbed between the fingers; it is produced by the grinding or crushing of a solid substance □ *the crystals were reduced to a powder by grinding; crystals of sodium carbonate left in air fall to a powder* —POWDER (*v.*) ***powdery*** (*adj.*) ↑ FORM[3] → PARTICLE

AB043 paste (*n.*) A mixture of a solid and a liquid that forms a sticky mass which adheres together. —***pasty*** (*adj.*) ↑ FORM[3]

AB044 foil (*n.*) A very thin smooth sheet of metal. ↑ FORM[3]

AB045 consistency[2] (*n.*) The degree of coherence of a colloidal or fluid material, *e.g.* ***a*** the consistency of a jelly; ***b*** the consistency of a thick paste or a thin paste; ***c*** the consistency of cream. ↑ MATTER

AB046 pound (*v.t.*) To hit with heavy blows, *e.g.* using a large hammer. ↓ POWDER[3] · PULVERIZE · TRITURATE ↑ FORM[3] → CRUSH (Sn) · GRIND (Sn)

AB047 powder[3] (*v.t.*) To reduce a solid substance to a powder; the method is not indicated. —POWDER (*n.*) ↓ PULVERIZE (Sn) ↑ POUND

AB048 pulverize (*v.t.*) To reduce a solid substance to a powder by pounding it into fine particles —***pulverization*** (*n.*) ↑ POUND

→ GRIND

AB049 triturate (*v.t.*) To mix two or more solids or a solid and a liquid by grinding them together. —***trituration*** (*n.*) ↑ POUND

AB050 porous[1] (*adj.*) Describes a material full of pores (minute holes) through which pure liquids, solutions or gases can pass, *e.g.* a brick is porous; a piece of glass is not. —***porosity,*** PORE (*n.*) ↓ PERFORATE · PERFORATED · NON-POROUS (I) ↑ FORM[3] → PORE

AB051 perforate (*adj.*) Describes a biological structure having pores. ↑ POROUS

AB052 perforated (*adj.*) **1** Describes a flat piece of material that has many small holes (**perforations**) which have been made deliberately to pass right through. **2** Describes a structure of an animal which has a hole in it, caused by a wound or a pathological condition, *e.g.* an ear-drum can be perforated either because a sharp instrument has pierced it, or because an infection has ruptured it. —***perforate*** (*v.*) ***perforation*** (*n.*) ↑ POROUS

AB053 non-porous (*adj.*) (Of a solid) without pores; not porous. ↑ POROUS (I)

AB054 friable (*adj.*) Able to be crumbled easily; crumbly □ *loam is a friable soil* —***friability*** (*n.*) ↓ CRUMBLED (Cs) ↑ FORM[3] → CRUMB

AB055 crumbled (*adj.*) Describes a solid substance or solid material that has crumbled or has been crumbled. ↑ FRIABLE → CRUMBLE

AB056 property (*n.*) One of the ways in which an object, substance, material, force or wave motion can be recognized, by appearance or behaviour. The properties of a substance are physical or chemical. Examples of physical properties include: size, shape, smell, colour, solubility, melting point, boiling point. Chemical properties include reactions which change one substance into other different substances, *e.g.* the substance copper (II) carbonate is changed by heat into the substances copper (II) oxide and carbon dioxide; this is a chemical property of copper (II) carbonate ↓ INTENSIVE PROPERTY · EXTENSIVE PROPERTY · NATURE[2] · BEHAVIOUR[2] · MASS · ELASTIC[1] · PHYSICAL → MATTER

AB057 intensive property (*n.*) A property which depends on the amount of matter, *e.g.* mass, volume, area, length, heat capacity and electrical resistance all depend on the amount of matter. ↑ PROPERTY

AB058 extensive property (*n.*) A property which does not depend on the amount of matter, *e.g.* colour, density, melting point and boiling point are all independent of the amount of matter, *e.g.* the boiling point of 3 g of water is the same as the boiling point of 6 g of water. ↑ PROPERTY

AB059 nature[2] (*n.*) The combination of essential qualities and properties of matter or energy, *e.g.* ***a*** it is part of the nature of reflected light to be polarized; ***b*** the ability to exist in different crystal forms is part of the nature of sulphur; ***c*** that an image formed by a lens should be real or virtual, magnified or diminished, erect or inverted, is the nature of the image □ *the nature of* ↓ FEATURE[2] · ATTRIBUTE ↑ PROPERTY → DISPOSITION QUALITY[1] · CHARACTERISTIC[1] · FUNCTION[1]

AB060 feature[2] (*n.*) One of the distinctive properties of an object, especially an important property □ *external features; important features* ↑ NATURE[2]

AB061 attribute (*n.*) An essential and permanent quality, *e.g.* the ability to walk on two legs is an attribute of man and the apes. ↑ NATURE[2]

AB062 behaviour[2] (*n.*) The characteristic reactions produced by outside agents or by the environment on an object, substance or radiation, *e.g.* ***a*** the behaviour of the halogens with solutions of alkalis; ***b*** the behaviour of a compass in a magnetic field; ***c*** the behaviour of electrons in a magnetic field; ***d*** the behaviour of light at an air-glass surface. —***behave*** (*v.*) ↑ PROPERTY → REACTION · BEHAVIOUR[1]

AB063 mass (*n.*) One of the fundamental properties of matter, *i.e.* all matter possesses mass; it is that property of a piece of matter which causes it to be attracted to any other piece of matter by gravitational force. The force attracting an object to the earth is the object's *weight.* The mass of an object also measures its inertia, *i.e.* the resistance to a force applied to set it in motion or change its motion. Mass is measured in kilogrammes. ↓ REFRACTIVITY · REFRACTORINESS ↑ PROPERTY

AB064 refractivity (*n.*) **1** The property of materials and substances to refract light. **2** A measure of the refractive power of a material or substance; it is numerically equal to $(n - 1)$ where n is the Refractive Index of the material or substance. —REFRACTORINESS, REFRACTION (*n.*) REFRACTORY (*adj.*) REFRACT (*v.*) ↑ MASS → REFRACT · REFRACTIVE INDEX

AB065 refractoriness (*n.*) The property of materials and substances of being able to be heated to a high temperature without melting and without losing their other properties, *e.g.* the bricks used for building houses exhibit refractoriness. ↑ MASS → REFRACTORY

AB066 elastic[1] (*adj.*) Able to recover the original size or shape after being distorted. —***elasticity*** (*n.*) ↓ PLASTIC[1] (An) · DUCTILE[2] · INELASTIC (Ag) ↑ PROPERTY

AB067 plastic[1] (*adj.*) Describes a substance which is able to have its shape changed in any direction by pressure, without being broken, and which is able to keep that shape when the pressure is removed, *e.g.* plasticene is a plastic substance. Contrast **malleable**, which describes a substance that can have its shape changed by hammering or by rolling. —PLASTICITY (*n.*) ↑ ELASTIC[1] (An) → MALLEABLE (H)

AB068 ductile[2] (*adj.*) Describes a substance or material that can be drawn out into a wire (one of the distinctive physical

properties of metals), *e.g.* copper is ductile. —***ductility*** (*n.*) ↑ ELASTIC[1]

AB069 inelastic (*adj.*) Describes a solid which is apparently not elastic, as far as can be observed. All solids are either elastic or plastic, but an elastic solid for which the distortion is so small as to be negligible is called inelastic, *e.g.* concrete is usually considered to be inelastic since the distortion from a force is so small that it can be ignored for most considerations; the breaking point is reached before distortion becomes important. ↑ ELASTIC[1] (Ag)

AB070 physical (*adj.*) Concerning properties, behaviour or qualities that do not involve the formation of new substances. In a physical change no new substances are formed but the substance may change its state or its crystal structure. ↓ PHYSICAL APPEARANCE · CHEMICAL[1] · BIOLOGICAL · BIOCHEMICAL ↑ PROPERTY → PHYSICAL CHANGE · PHYSICAL NATURE

AB071 physical appearance (*n.*) The visible physical properties of matter, *e.g.* the shape, colour or surface of a piece of matter. ↑ PHYSICAL

AB072 chemical[1] (*adj.*) Concerning the production of new substances, by the interaction between substances, or by the effect of heat energy or electrical energy on substances, *e.g.* ***a*** in a chemical change, new substances are formed; ***b*** in a chemical reaction substances interact to form new substances; ***c*** chemical energy is the energy produced or which can be produced by a chemical reaction. —CHEMICAL (*n.*) ↑ PHYSICAL

AB073 biological (*adj.*) Of or to do with living organisms or with the study of living organisms, *e.g.* ***a*** the biological factors of an environment consist of the plants and animals in the environment; ***b*** decay is a biological process. ↑ PHYSICAL

AB074 biochemical (*adj.*) Of or to do with the chemical reactions in living organisms, *e.g.* the biochemical reactions in the decomposition of proteins to amino acids. ↑ PHYSICAL

Shape

AC001 form[1] (*n.*) Form is a generalization of shape, *e.g.* each horse has its own individual shape, but there are a large number of possible shapes that have the form of a horse. A knowledge of the form of a horse allows us to distinguish it from other animals; a knowledge of the shape of a horse allows us to distinguish it from other horses □ *form of* —FORM (*v.*) ***formal, formless*** (*adj.*) ↓ FORM[2] · DEFORMATION · DISTORTION[1] · DEFORMITY · DEFORMABILITY · FEATURE[1] · ARRANGEMENT · NETWORK · DEFORM · RETICULAR · INITIAL · DEFORMED · QUALITY[1] · PERFECTION · STRATUM[1] · ANNULUS ↑ SPACE[1]

AC002 form[2] (*n.*) The general overall character of an object, substance or energy. It is a generalization of other properties besides shape, *e.g.* ***a*** solid sulphur exists in two crystalline forms (rhombic and monoclinic). Each form has its own crystal structure and physical properties, but is still sulphur. Rhombic and monoclinic sulphur are different forms of the same substance. ***b*** Heat is a form of energy with different properties from other forms of energy, such as mechanical energy and electrical energy. Contrast **form** and **type:** form is often used when a change from one form to the other is possible, *e.g.* rhombic and monoclinic sulphur are different forms of sulphur but sulphur and iron are different **types** of matter (it is possible to change rhombic sulphur into monoclinic sulphur but it is not possible to change sulphur into iron; the difference between sulphur and iron is greater than the difference between rhombic and monoclinic sulphur). Heat, mechanical energy, and electrical energy are different forms of energy. ↑ FORM[1]

AC003 deformation (*n.*) **1** The process in which an object's shape or form is changed permanently, *e.g.* the deformation of a rubber band by an excessive force, causing a permanent change in shape. **2** The amount by which an object is deformed from its natural state, *e.g.* when a metal wire is extended beyond its elastic limit, the increase in length is the deformation, *e.g.* a deformation of 3 cm on stretching a long wire. ↑ FORM[1]

AC004 distortion[1] (*n.*) **1** The process of temporarily changing the shape, form or nature of an object, *e.g.* the distortion of a rubber band by a moderate force; when the force is removed the rubber band returns to its original shape. **2** The amount by which anything is distorted from its original form; the distortion may be observable only in qualitative terms, *e.g.* excessive distortion of sound by an amplification system. —***distort*** (*v.*) ***distorted*** (*adj.*) ↑ FORM[1]

AC005 deformity (*n.*) The state of a whole or a part being deformed; the abnormal shape of a part caused by deforming, *e.g.* ***a*** when a metal wire is extended beyond its elastic limit, the increase in length is the deformity; ***b*** a person with one finger missing has a deformity; the deformity is the missing finger. —DEFORMATION, DEFORMABILITY (*n.*) DEFORM (*v.*) ↑ FORM[1]

AC006 deformability (*n.*) The extent to which an object, substance or material can be deformed by a force, *e.g.* the deformability of copper is greater than the deformability of stone (it is easier to deform copper). ↑ FORM[1]

AC007 feature[1] (*n.*) One of the properties, qualities or other details of form or function possessed by substances, organisms or radiations. ↓ CHARACTERISTIC[1] ↑ FORM[1] → EXTERNAL FEATURES · FUNCTION · CLASSIFY

AC008 characteristic[1] (*n.*) A quality, property or other feature that distinguishes an individual from the other members of its group, or a group of organisms from all other groups of organisms. The term is mainly applied to living organisms: contrast **property** which is only applied to non-living matter □ *the characteristic of* —CHARACTERISTIC (*adj.*) ↑ FEATURE[1] → NATURE · PROPERTY · QUALITY

AC009 arrangement (*n.*) The way in which objects are placed, *e.g.* ***a*** the arrangement of houses in a town; ***b*** the arrangement of ions in a crystal. —***arrange*** (*v.*) ↓ STRUCTURE[1] · CONFIGURATION · SYSTEM[1] · PATTERN · HIERARCHY ↑ FORM[1]

AC010 structure[1] (*n.*) Any arranged collection or combination of connected and dependent parts, *e.g.* ***a*** the structure of a crystal; ***b*** the structure of an atom. **2** (Bio.) The arrangement of the component parts of a cell, tissue, organ, system or organism, *e.g.* ***a*** the structure of bone; ***b*** the structure of the kidney. —***structure*** (*v.*) ***structural*** (*adj.*) ↑ ARRANGEMENT → STRUCTURE[2] · CRYSTAL STRUCTURE · ATOMIC STRUCTURE

AC011 configuration (*n.*) The arrangement in the three dimensions of space of the parts or units of a whole to make an external form which can be recognized. The arrangement of such parts or units may be represented by a model or diagram in three dimensions. The configuration is the relative position of such parts or units, *e.g.* ***a*** configuration of atoms in a molecule; ***b*** the configuration of the ions in a sodium chloride crystal; ***c*** the configuration of valency electrons in a carbon atom can be represented by a model with a central core; ***d*** the configuration of a magnetic field is shown in a diagram by lines of force. ↑ ARRANGEMENT → FORM[1]

AC012 system[1] (*n.*) **1** A set of objects or substances which are associated and interdependent and governed by physical laws, forming a whole, *e.g.* the solar system comprising the sun and the planets (objects) is governed by the law of universal gravitation, and forms a unit (the whole). **2** A set of objects or structures, associated and interconnected so as to form a complex whole. It may, with a definite function, contain components that are exchangeable and interchanging. The focus is on the function of the system as a whole, *e.g.* ***a*** the electrical system of a car provides a spark for combustion of fuel (a complex structure of wires); ***b*** the circulatory system of a mammal supplies the function of oxygen transport (a complex interconnected vascular system in which red blood cells carry out the function). **3** A formal well-defined method of classification, nomenclature or notation, *e.g.* ***a*** the system of classifying elements by the Periodic Law; ***b*** the system of classifying organisms by Binomial Nomenclature; ***c*** the system of number notation using Arabic numerals; ***d*** the IUPAC system of classification of chemical compounds (it follows a set of defined rules). —***systematization*** (*n.*) ***systematize*** (*v.*) SYSTEMATIC, SYSTEMIC (*adj.*) ↑ ARRANGEMENT → SYSTEM[2] · METHOD · CHAOS (An)

AC013 pattern (*n.*) A repeated or regular arrangement of objects, events, properties, behaviour or characteristics. A pattern can be formed by repeated arrangements in space (configurations), *e.g.* the sodium and chloride ions in sodium chloride crystals form a three-dimensional pattern; ***b*** X-rays passed through a crystal form a pattern of spots on a photographic film; the recurrent configurations form a static pattern, *i.e.* a pattern which is standing still and can be seen all at once. A pattern of recurrent events or processes is a dynamic pattern, *i.e.* a pattern which appears at regular intervals of time, *e.g.* the distribution of mosquitoes spreading malaria in Ceylon depends on the rainfall; during the rainy season many people suffer from malaria. This forms a pattern of malarial disease (a dynamic pattern of processes with a time interval related to the climate of the country). Properties, characteristics, behaviour, etc., can also form a pattern if they are regular or repeated in some way, *e.g.* the halogen elements have a pattern of reactivity (the reactions of chlorine and its compounds are similar to those of bromine and its compounds, etc.). ↓ WEB ↑ ARRANGEMENT → LATTICE · GRATING

AC014 hierarchy (*n.*) A set of organisms or principles arranged in ascending or descending order of authority or function, *e.g.* the hierarchy of feeding: predators feed on herbivores; herbivores feed on plants □ *the terms are arranged in a hierarchy* —***hierarchical*** (*adj.*) ↑ ARRANGEMENT

AC015 network (*n.*) **1** The actual structure that forms a net, *e.g.* ***a*** the string in a fishing net forms the network; ***b*** the small veins in a leaf are a network of veins. The focus is on the elements that form the net, in the second case the small veins. **2** Any structure or system resembling a network, having a number of parts connected together in some way, *e.g.* ***a*** a network of railways; ***b*** a network of radio stations (connected together to broadcast the same programme); ***c*** a network of resistors (resistors connected together in a certain way by conductors). ↓ WEB[1] · RETICULATION (Sn) · MESH · GAUZE ↑ FORM[1]

AC016 web[1] (*n.*) A type of net similar to a spider's web. A web has a centre from which the net radiates, and the network is also interconnected in two ways; one radially, and one peripherally, *i.e.* at a common level or distance from the centre. When the term is applied in a **food web**, the elements are seen as, ***a*** a hierarchy of feeding (radial connection) and, ***b*** interconnection between the same level of feeding (peripheral

connection). ↑ NETWORK → FOOD WEB

AC017 reticulation (*n.*) The arrangement of a structure that forms a net, *e.g.* the small veins in a leaf form a network; the arrangement of the veins is a reticulation. The focus is on the type of connecting system, *e.g.* leaf veins can form a reticulation or a system of parallel bundles. Both network and reticulation imply a two-dimensional structure, usually on a surface. —***reticulate*** (*v.*) RETICULAR, RETICULATE, RETICULATED (*adj.*) ↑ NETWORK → POWDER[1]

AC018 mesh (*n.*) **1** The holes in a net, or network. **2** A measure of the size of the holes in a net, usually expressed as the number of holes per cm. **3** A measure of the size of grains and granules, measured by the mesh of a sieve which just allows them to pass through. ↑ NETWORK

AC019 gauze (*n.*) A thin material loosely woven out of fine threads or wires, *e.g.* copper gauze, woven from copper wires. The size of the spaces between the wires measures the mesh, *e.g.* a fine wire gauze has very small spaces and thus a small mesh. ↑ NETWORK → POWDER[1]

AC020 deform (*v.t.*) To change the form or shape of an object or organism permanently, so that the system cannot return to its original or natural shape, *e.g.* ***a*** stretching a rubber band beyond its elastic limit deforms the band because it cannot return to its original shape; ***b*** force deforms a piece of plasticene. —DEFORMATION, DEFORMITY, DEFORMABILITY (*n.*) DEFORMED, DEFORMABLE (*adj.*) ↓ DISTORT (Sn) · RESTORE ↑ FORM[1]

AC021 distort (*v.t.*) To change the shape, form or nature of an object, system, light or sound. When anything is distorted its original or natural form is changed, but the original can usually still be recognized, *e.g.* ***a*** a loudspeaker may distort a person's voice but the words may still be understood; ***b*** spherical aberration in a lens may distort an image but the image is still similar to the object; ***c*** stretching a rubber band distorts the band; its elasticity restores it to its original shape, providing the elastic limit is not exceeded. —DISTORTION (*n.*) ***distorted*** (*adj.*) ↓ RESTORE (Cn) ↑ DEFORM (Sn)

AC022 restore (*v.t.*) **1** To return objects to their original position or shape, *e.g.* ***a*** the force of elasticity restores a body to its original shape after a tensile force has ceased; ***b*** when a stable body is displaced, the force of gravity restores it to its original position. **2** To return a state of affairs to an original state, *e.g.* ***a*** passing an electric current through an accumulator restores the electrodes to their condition before discharge; ***b*** medicines are used to restore a person to health; ***c*** the compensatory action of sweating restores the temperature of a mammal to its normal level. —***restoration*** (*n.*) ***restorative, restoring*** (*adj.*) ↑ DEFORM · DISTORT (Cn)

AC023 reticular (*adj.*) Of or to do with a network, or reticulation, *e.g.* reticular tissue in lymphatic vessels ↓ RETICULATE · RETICULATED · PROMINENT · CHARACTERISTIC[2] ↑ FORM[1]

AC024 reticulate (*adj.*) Possessing a reticulation or reticular structure, or having reticular markings or appearance, *e.g.* ***a*** the nucleus in a cell appears reticulate. The term is used to describe living organisms, in which the reticulation appears naturally. ↑ RETICULAR

AC025 reticulated (*adj.*) Possessing a reticulation that has been made, *e.g.* reticulated drainage ditches are used in a large field (they have been dug in that arrangement). ↑ RETICULAR

AC026 prominent (*adj.*) Describes any structure projecting out and thus easily seen, *e.g.* a beak is a prominent feature of some birds such as the eagle. ↑ RETICULAR

AC027 characteristic[2] (*adj.*) Describes a property, feature or quality that distinguishes an object or an organism from all other objects or organisms, *e.g.* ***a*** respiration is a characteristic feature of all living organisms; ***b*** the production of positive ions is a characteristic property of all metals; ***c*** lustre is a characteristic quality of all metals. ↑ FORM[1]

AC028 initial (*adj.*) Describes the first position in an arrangement or the first event at the beginning of a process, *e.g.* ***a*** the first letter of a word is the initial letter; ***b*** the first reading or result in an experiment is the initial reading; ***c*** the temperature at the start of a process is the initial temperature. —***initially*** (*adv.*) ↓ FINAL · INTERMEDIATE · ULTIMATE[1] ↑ FORM[1]

AC029 final (*adj.*) Describes the last position in an arrangement or the last event or stage in a process as far as the observer is concerned, *e.g.* the final stage in distillation is the collection of the distillate. —***finality*** (*n.*) ***finally*** (*adv.*) ↑ INITIAL

AC030 intermediate (*adj.*) Describes any position, event or stage between the initial and final ones. ↑ INITIAL

AC031 ultimate[1] (*adj.*) Describes that which is last in time, and beyond which it is not possible to go either in perception or in thought, *e.g.* ***a*** the ultimate questions for which there are no explanations; ***b*** the ultimate spread of a species of predator depends solely on the availability of prey. ↑ INITIAL

AC032 deformed (*adj.*) Describes an object, organism or part of an object, or part of an organism, which is out of its natural shape, *e.g.* ***a*** a baby born with no fingers is deformed; ***b*** a crystal in which growth is not regular, but is disoriented at a particular boundary, is deformed. Both of these examples are those of deformation arising from natural causes. An object which has been altered out of its original shape by a force is also deformed. ↓ DISTORTED (Sn) ↑ FORM[1]

AC033 distorted (*adj.*) **1** Describes an elastic solid that has been made out of shape by an external force, *e.g.* when a steel spring is stretched by a force it is distorted. **2**

Describes sounds or light images which have been put out of their original form, *e.g.* an irregularly shaped mirror produces a distorted image of an object. ↑ DEFORMED

AC034 quality[1] (*n.*) One of the properties by which an object, substance, sound or light can be recognized and described according to its appearance or behaviour. A quality of an object or radiation is a property or characteristic that can vary, *e.g.* ***a*** the purity of a chemical is one of its qualities. There is a scale with pure at the top and decreasing purity down the scale. ***b*** Lustre is a quality of metals; some metals have a high degree of lustre, some are less lustrous, and some are not lustrous at all; ***c*** temperature is a quality (hot or cold) which may be made numerical on a temperature scale. —QUALITATIVE (*adj.*) ***qualitatively*** (*adv.*) ↓ COLOURED · TRANSPARENT · QUALITATIVE → OBSERVATION · ABSTRACTION · PERCEPT · CONCEPT

AC035 coloured (*adj.*) Describes an object, or light, which has colour, without naming the colour, *e.g.* a coloured precipitate can be blue, red, green, etc. Coloured is usually contrasted with white, while black is included with the true colours, *i.e.* a black precipitate is called a coloured precipitate. ↓ COLOURLESS (I) · CLEAR[1] · WHITE ↑ QUALITY[1]

AC036 colourless (*adj.*) Describes a solid, liquid, or gas, which has no colour, *e.g.* ***a*** water is colourless; ***b*** air is colourless; ***c*** a diamond is colourless. ↑ COLOURED (I)

AC037 clear[1] (*adj.*) Describes a liquid which is transparent. The liquid may be coloured or colourless, *e.g.* copper (II) sulphate is blue, but the solution is clear; similarly water is clear although it is colourless. ↑ COLOURED → OPALESCENT (Ag)

AC038 white (*adj.*) Describes a solid or liquid which reflects all light, *e.g.* milk is white, chalk is white. To contrast **white** and **colourless**: milk is white but water is colourless. ↑ COLOURED

AC039 transparent (*adj.*) **1** Describes an object or medium through which light can travel with the smallest amount of scattering, *e.g.* water is a transparent medium. It is possible to see clearly through a transparent object. **2** Describes an object or medium which allows the passage of other radiation, *e.g.* lithium is transparent to X-rays (X-rays can pass through lithium). ↓ OPAQUE (Ag) · TRANSLUCENT (Sn) · OPALESCENT · FROSTED · IRIDESCENT ↑ QUALITY[1]

AC040 opaque (*adj.*) **1** Describes an object or medium which does not allow the passage of light of wave length in the visible range, *e.g.* a piece of cardboard is opaque (it is not possible to see through it). **2** Describes a medium or object which does not allow the passage of any other specified radiation, *e.g.* lead is opaque to X-rays (X-rays cannot pass through lead). ↑ TRANSPARENT (Ag)

AC041 translucent (*adj.*) Describes an object or medium in which the particles are sufficiently large to scatter light passing through it, so preventing any image of objects being formed on the other side. Thus it is not possible to see clearly through a translucent medium, although light can pass through. Solids and liquids can be translucent, *e.g.* ground glass and milk are translucent mediums (or media). ↑ TRANSPARENT (Sn)

AC042 opalescent (*adj.*) Describes a translucent substance which has a milk-like colour and may be iridescent, *e.g.* most electric light bulbs are opalescent. —***opalescence*** (*n.*) ↓ IRIDESCENT ↑ TRANSPARENT

AC043 frosted (*adj.*) Describes the surface of a piece of glass which has been made rough so that the glass is no longer transparent, but is translucent instead. An image can be formed on a frosted surface, as on a screen. ↑ TRANSPARENT → IMAGE

AC044 iridescent (*adj.*) Describes a surface having colours like those on a soap bubble, *i.e.* the colours change with the direction of observation or with the direction of light. The colours are caused by the interference of light waves reflected from the two sides of a very thin surface, *e.g.* the feathers of some birds are iridescent. —***iridescence*** (*n.*) ***iridesce*** (*v.*) ↑ TRANSPARENT

AC045 qualitative (*adj.*) Describes experiments, observations or results, in which no measurements are involved. Qualitative experiments produce descriptive observations, not numerical values, *e.g.* ***a*** a qualitative experiment on the germination of seeds gives information on the conditions of germination; ***b*** an experiment demonstrating that the change in the volume of a gas causes a change in pressure is qualitative if the pressures and volumes are not measured; it gives a qualitative description of the system. Qualitative analysis in chemistry leads to information about the identity of the substances present but not the amount of each substance □ *a qualitative description; a qualitative approach* ↑ QUALITY[1]

AC046 perfection (*n.*) The state or quality of being perfect. ↓ IMPERFECTION · PERFECT[1] ↑ FORM[1]

AC047 imperfection (*n.*) Anything causing departure from perfection. Imperfections may be flaws, defects, faults or deficiencies. —***imperfect*** (*adj.*) ↓ DEFECT (Sn) · FAULT (Sn) · FLAW (H) · DEFICIENCY (H) · DISORDER[1] (H) ↑ PERFECTION

AC048 defect (*n.*) An imperfection caused by a missing part, property, or characteristic essential to the whole for perfection, *e.g.* ***a*** the mass defect is the slight difference between the actual mass of an isotope, and the sum of the masses of neutrons and protons in the nucleus; ***b*** a crystal lattice with a hole which should be occupied by an ion has a defect; ***c*** a defect in vision is caused by the loss in elasticity (a property) of the crystalline lens. A defect is made good when the missing part is added □ *a serious defect in vision; a minor defect in the design of a loudspeaker* —DEFECTIVE (*adj.*) ↓ FAULT (Sn)

↑ IMPERFECTION (Sn)

AC049 fault (*n.*) An imperfection in any apparatus, piece of machinery or electrical circuit which interferes with its normal function. Normally the fault can be corrected, *e.g.* a loose connection in an ammeter is a fault causing the ammeter not to function properly □ *a major fault is more difficult to correct than a minor fault; a trivial fault can easily be located, and is not serious* —***faulty*** (*adj.*) ↑ IMPERFECTION (Sn) · DEFECT (Sn)

AC050 flaw (*n.*) A discontinuity or lack of cohesion, in a solid material or structure, causing a structural weakness; a flaw may be a crack, fracture or fissure. —***flawed*** (*adj.*) ↑ IMPERFECTION

AC051 deficiency (*n.*) A lack of some quality or constituent causing imperfection, *e.g.* insufficient meat may cause a deficiency of protein in the diet (the diet contains protein but not enough for perfection). A **deficiency disease**, such as scurvy or beri beri, is a disease caused by lack of some vitamin or mineral salt in the diet. Contrast **deficiency** with **defect**: a deficiency is a lack in the quality of some part of a whole. A defect is a fault or imperfection that may be caused by a deficiency or by some other effect, *e.g.* the lack of a pointer in an ammeter is a defect (lack of a part) □ *a gross deficiency or severe deficiency of protein causes kwashiorkor; a mild deficiency of protein produces little effect.* ↑ IMPERFECTION → DEFICIENT

AC052 disorder[1] (*n.*) A lack of order; an absence of any pattern or regular arrangement, *e.g.* ***a*** when a crystal melts, disorder is produced in the particles, which lose their fixed locations in the crystal lattice; ***b*** iron filings on a piece of paper with a magnet underneath set themselves in the pattern of the magnetic field; when the magnet is removed and the paper shaken, the pattern is destroyed and the iron filings are in disorder. ↑ IMPERFECTION → STATE OF AFFAIRS

AC053 perfect[1] (*adj.*) Describes the presence in an object or organism of every part, property, and characteristic essential to its finished or fully developed state, and to its proper function, *e.g.* ***a*** a perfect sphere; ***b*** a perfect set of teeth. —***perfection*** (*n.*) PERFECT (*v.*) ↓ IDEAL · IMPERFECT (An) · NON-IDEAL ↑ PERFECTION → PERFECT[2]

AC054 ideal (*adj.*) Describes an object, event, process, system, theory, that is perfect, especially a hypothetical one which could not actually exist. —***ideality*** (*n.*) ↓ NON-IDEAL (Cn) ↑ PERFECT[1] → HYPOTHESIS

AC055 imperfect (*adj.*) Describes an object, configuration, sequence, process or quality that is not perfect. —IMPERFECTION (*n.*) ↑ PERFECT[1] (An)

AC056 non-ideal (*adj.*) Describes a natural object, event or process, which does not reach a state of hypothetical perfection in real existence, *e.g.* any real gas is a non-ideal gas as it does not conform perfectly to Boyle's Law. ↑ IDEAL (Cn) · PERFECT[1]

AC057 stratum[1] (*n.,pl.* **strata**) A layer of material with approximately parallel surfaces, usually with layers of different materials on either side. ↓ CONCENTRIC ↑ FORM[1]

AC058 concentric (*adj.*) Having the same centre or axis, *e.g.* in the Frasch process for the extraction of sulphur three concentric tubes are used one inside the other. The tubes have the same axis and a cross-section shows three concentric circles. —***concentricity*** (*n.*) ↑ STRATUM[1]

AC059 annulus (*n.,pl.* **annuli, annuluses**) A circular ring-shaped structure; the diameter is much greater than its length. —ANNULAR (*adj.*) ↓ TUBE · CHANNEL · CYLINDRICAL · TUBULAR ↑ FORM[1] → CYLINDER

AC060 tube (*n.*) A hollow cylinder with its length much greater than its diameter. The focus is on the structure. —TUBING (*n.*) TUBULAR, TUBULATE, TUBIFORM (*adj.*) ↓ TUBULE · PIPE (Sn) · TUBING · PIPING · DUCT ↑ ANNULUS → CYLINDER

AC061 tubule (*n.*) A tube of very fine diameter. ↑ TUBE → CAPILLARY TUBE

AC062 pipe (*n.*) A tube used for the conduction of fluids; the focus is on the function of conducting substances. Compare **tube** and **pipe**: a pipe is used to conduct fluids, but a tube does not necessarily conduct fluids. —PIPING (*n.*) ***pipe*** (*v.*) ↑ TUBE

AC063 tubing (*n.*) Material in the form of a tube or tubes, *e.g.* rubber tubing or glass tubing is used in scientific experiments (such tubing is of assorted sizes and lengths) □ *a length of tubing suitable to join two containers; a piece of copper tubing to act as a safety tube* ↑ TUBE

AC064 piping (*n.*) Material in the form of a pipe or pipes, or a system of pipes joined together, *e.g.* the piping used in a water-supply system. ↑ TUBE

AC065 duct (*n.*) A pipe with an outlet, discharging fluids from one system to another, *e.g.* ***a*** the bile duct discharges bile from the liver into the alimentary canal; ***b*** a hot-air duct is a pipe which discharges hot air from a heating device into a room. —***ductless*** (*n.*) ***duct*** (*v.*) ↑ TUBE

AC066 channel (*n.*) A passage along or through which movement can occur; the channel has the disposition to guide a moving object or fluid, *e.g.* when an artery is blocked, blood finds new channels through tissues (the focus is on the continuity of movement of the blood). The focus is on the movement. —***channel*** (*v.*) ↓ CANAL · CANALICULUS[1] · GROOVE ↑ ANNULUS

AC067 canal (*n.*) A tube or other passage of varying structure along which a fluid or substance can move in one direction, especially in a living organism, *e.g.* the alimentary canal is for the passage of food. The focus is on the substance conducted. —CANALICULUS (*n.*) ↑ CHANNEL

AC068 canaliculus[1] (*n.,pl.* **canaliculi**) A very small canal, of the same structure throughout. ↑ CHANNEL

AC069 groove (*n.*) A narrow depression in a solid or tissue; it is of definite length and the focus is on its structure. Compare

channel, which is similar in shape, when small, but the focus is on the movement of objects in the channel, *e.g.* a record has a continuous spiral groove (structure); the groove acts as a channel for a stylus gramophone needle (focus on movement) ▭ *a deep groove cut in a piece of wood; a shallow groove cut in the surface of a piece of metal; to cut a groove* —***grooved*** (*adj.*) ↑ CHANNEL → FURROW (Sn)

AC070 cylindrical (*adj.*) Possessing the external shape of a cylinder. ↓ ANNULAR[1] ↑ ANNULUS → CYLINDER

AC071 annular[1] (*adj.*) Shaped like an annulus. ↑ CYLINDRICAL · ANNULUS

AC072 tubular (*adj.*) **1** Having the form of a tube. **2** Consisting of tubes. ↓ TUBULATE · TUBIFORM ↑ ANNULUS → CYLINDER · VASCULAR

AC073 tubulate (*adj.*) Constructed with tubes; having a structure consisting of tubes. ↑ TUBULAR

AC074 tubiform (*adj.*) Having the form of a tube. ↑ TUBULAR

Existence

AD001 cause (*v.t.*) To make an event or a process occur or take place, *e.g.* ***a*** a stress applied to an elastic solid causes an extension; the stress is the cause and the extension is the **effect**; ***b*** heat causes the expansion of a metal. —***cause*** (*n.*) ↓ EXISTENCE · BE · HAPPEN · CONTACT[1] · FORMATION[1] · START · FORM[5] · BECOME · HEAT ↑ SPACE[1] → PROCESS · EVENT

AD002 existence (*n.*) The state of existing in the world of space and time, having characteristics or properties by which to be identified, *e.g.* ***a*** our senses inform us of the existence of water which we identify by its properties; ***b*** the existence of the electron is based upon indirect observation of its effects; ***c*** the existence of extinct animals is based on evidence from fossils. ↓ OCCURRENCE ↑ CAUSE

AD003 occurrence (*n.*) **1** The fact of occurring in a place, *e.g.* the occurrence of coal in North Europe has been a known fact for over four hundred years. **2** The act of occurring in time, *e.g.* the occurrence of an eclipse of the sun on a particular date. ↓ BE · HAPPEN ↑ CAUSE

AD004 be (*v.i.*) **1** To exist in a specified place, *e.g.* the acid is in the bottle and the bottle is on the table. **2** To exist or take place at a specified time, *e.g.* the eclipse of the sun is tomorrow. **3** The verb 'to be' is used to join words or phrases that have the same meaning or are equivalent in some way, *e.g.* ***a*** the liquid is pure (*liquid* is the subject and *pure* is one of its qualities); copper is a metal (*copper* belongs to the class of *metals*); ***c*** tungsten is a hard metal (*tungsten* and *a hard metal* are equivalent) —***being*** (*n.*) ↓ EXIST · TAKE PLACE · EXTEND[3] · EFFECT[2] · ACCOMPLISH · ACHIEVE ↑ CAUSE

AD005 exist (*v.i.*) **1** To be real, *i.e.* to be perceivable by the senses, *e.g.* ***a*** hydrogen chloride exists but helium chloride does not exist (there is a compound hydrogen chloride but there is no compound helium chloride). **2** To continue to be over a period of time, *e.g. Eohippus*, the ancestor of the modern horse, existed only during the Eocene epoch. **3** To be found or occur under certain conditions, *e.g.* sulphur exists in different allotropic forms (the form depends on the way it is made). ↑ BE → FIND

AD006 take place (*v.i.*) **(took place)** (Of an event) to start to be, to come into being, especially when planned, *e.g.* ***a*** a chemical reaction takes place as part of a controlled experiment; ***b*** iron and sulphur mixed together do not react, but when the mixture is heated, the reaction takes place, as planned. ↓ HAPPEN · OCCUR ↑ BE

AD007 extend[3] (*v.t.,i.*) **1** (*v.i.*) To take up space between two points or limits, or to take up time between limits, *e.g.* ***a*** the small intestine extends from the stomach to the colon; ***b*** the biting activity of anopheline mosquitoes generally extends from sunset to sunrise. **2** (*v.t.*) To cause to extend. —EXTENT (*n.*) ↑ BE → EXTEND[1]

AD008 effect[2] (*v.t.*) To cause an observable change or an effect. The focus is on the agent being sufficiently strong to cause the change or effect, *e.g.* ***a*** a temperature above 900°C is required to effect the decomposition of calcium carbonate (a temperature below this is not sufficiently high to cause the complete decomposition); ***b*** the decolorization of potassium manganate (VII) is not effected by propanone (acetone). —EFFECT (*n.*) ↑ BE

AD009 accomplish (*v.t.*) To bring a process to an intended and satisfactory conclusion. The focus is on the satisfactory completion, *e.g.* after seven years work, C. T. R. Wilson accomplished his purpose in producing a cloud chamber for the examination of the tracks of atomic particles. ↑ BE

AD010 achieve (*v.t.*) To bring a process to a conclusion by obtaining a result. The focus is on the effort needed to complete the process, *e.g.* Madame Curie finally achieved the separation of radium bromide from barium bromide by fractional crystallization over a period of four years. —***achievement*** (*n.*) ↑ BE

AD011 happen (*v.i.*) (Of an event) to come into being unexpectedly; the focus is on the event, *e.g.* an accident happened yesterday in the street. Contrast accidents **occur** frequently at that point (it is not possible to say when an accident will happen, but because

of the frequency, it can be predicted that accidents will occur at that point). —***happening*** (*n.*) ↓ OCCUR · FIND · RECUR[2] · BRING ABOUT · INFLUENCE · INDUCE · ENCOURAGE · FAVOUR ↑ CAUSE → OCCURRENCE

AD012 occur (*v.i.*) **1** To be present in a certain place, *e.g.* coal occurs in North Europe. Contrast **occur** and **exist**: coal occurs in North Europe; coal exists on the earth but naturally occurring coal does not exist on the moon. **2** (Of events) to be present at a certain time; the term suggests that the events can be predicted, *e.g.* eclipses of the moon occur each year. Contrast **occur** and **take place**: a reaction takes place; it does not occur because it did not exist before and was not planned. Contrast also **occur** and **happen**: with occur the focus is on what occurs, *e.g.* an eclipse of the moon occurs; with happen, the focus is on the event and its unexpected nature. —OCCURRENCE (*n.*) ↓ RECUR[2] ↑ HAPPEN · BE · EXIST

AD013 find (*v.t.*) (**found**) To meet by accident or after a search. In passive sentences, find corresponds to the verbs **occur**, **exist** and **live**, *e.g.* ***a*** coal occurs in Europe *or* coal is found in Europe; ***b*** sulphur exists in several forms *or* sulphur is found in several forms; ***c*** kangaroos live in Australia *or* kangaroos are found in Australia. ↑ HAPPEN · OCCUR → LIVE[1]

AD014 recur[2] (*v.i.*) To occur again and again; often at regular intervals of time, *e.g.* the appearances of Halley's comet recur every 75 years. —***recurrence*** (*n.*) ***recurring*** (*adj.*) ↑ HAPPEN · OCCUR

AD015 bring about (*v.t.*) When particular conditions or factors are followed by a specific cause to produce an observed event or process, the conditions or factors bring about the event. The conditions or factors may be regarded as a secondary cause of the effect, *e.g.* ***a*** the change from moist to arid conditions (the factor) of the climate may have brought about the extinction of the dinosaurs; the cause of the dinosaurs becoming extinct was their inability to adapt to the new conditions; ***b*** the decrease in the intensity of light (the conditions) in the evening brings about a nastic movement (an event) in some plants whereby the leaves fold up and reduce the surface area; the cause of the movement is a change in turgor of the cells at the base of the leaf. ↑ HAPPEN

AD016 influence (*v.t.*) (Of an object, organism, substance or condition) to act upon an object, organism or system, without any direct or obvious connection between the action and its effect, *e.g.* ***a*** a piece of iron is influenced by a magnet (magnetism is induced in the iron although there is no physical connection between the iron and the magnet); ***b*** the tides are influenced by the moon (the position of the moon causes the tides by its gravitational pull, although there is no obvious connection); ***c*** a catalyst influences the rate of a chemical reaction (the catalyst increases the rate without changing itself chemically) —***influence*** (*n.*) ↑ HAPPEN

AD017 induce (*v.t.*) To obtain an effect in an object or organism in a manner where there is no apparent connection between the agent causing the effect and the object or organism in which the effect is observed, *e.g.* ***a*** a magnet induces magnetism in a piece of soft iron which is not in contact with it; ***b*** small doses of toxins induce a host to manufacture anti-toxins. The focus is on the effect obtained. Contrast **influence** in which the focus is on the agent, *e.g.* the magnet influences the soft iron, but magnetism is induced in the soft iron. —INDUCED (*adj.*) INDUCTION (*n.*) ↑ HAPPEN

AD018 encourage (*v.t.*) To cause a natural process to occur more quickly or with better results, *e.g.* ***a*** removing the apical bud encourages the growth of lateral buds (lateral buds grow naturally but more are produced if the apical bud is removed); ***b*** scratching the side of a test tube encourages crystals to form from a supersaturated solution (crystals may form anyway in time but the scratching encourages them to form more quickly). —***encouragement*** (*n.*) ↑ HAPPEN → DISCOURAGE (Cn)

AD019 favour (*v.t.*) To provide suitable conditions for a natural process, *e.g.* ***a*** in a solution containing Zn^{2+} ions, the presence of excess hydroxyl ions favours the formation of ZnO_2^{2-} ions; ***b*** a high humidity favours the growth of a colony of bacteria. —FAVOURABLE (*adj.*) ↑ HAPPEN → FAVOURABLE

AD020 contact[1] (*n.*) The state or condition of touching. An electrical contact implies that electric current can flow because two objects are touching, *e.g.* ***a*** a plate of zinc in contact with a solution of a zinc salt means that the plate and the solution are touching, but does not indicate whether the plate is immersed in the solution or not; ***b*** gases come into contact with a catalyst. Note that radiation and energy cannot come into contact with matter; only material substances can come into contact □ *an electrical contact is made when a switch is closed; undissolved solid is in contact with a saturated solution; a contact is broken when a switch is opened; sulphur crystals heated out of contact with the air, melt to liquid sulphur* —CONTACT (*v.*) ↓ FORMATION[1] · START · FORM[5] ↑ CAUSE

AD021 formation[1] (*n.*) The act of being formed. ↑ CONTACT[1] → PRODUCTION · MANUFACTURE · PREPARATION

AD022 start (*v.t.,i.*) **1** (*v.t.*) To change from inaction to action, *e.g.* ***a*** the water started to boil when the correct temperature was reached; ***b*** the reaction started immediately the bromine was added. **2** (*v.i.*) To come into operation, *e.g.* an electric motor starts when the current is switched on. **3** (*v.t.*) To cause to start, *e.g.* ***a*** the student started an experiment; ***b*** the driver turned the key to start the engine. Contrast **start** and **begin**: begin (making) the engine, *i.e.* building the engine; start the engine *i.e.* so that it is functioning —***start*** (*n.*) Note also the

contrasting pairs: **start** and **stop; begin** and **end; commence** and **conclude.** ↓ BEGIN · COMMENCE · INITIATE · STOP (Cn) · END · FINISH (Cn) · CONCLUDE · TERMINATE ↑ CAUSE

AD023 begin (*v.t.,i.*) **(began, begun) 1** (*v.t.*) To come into being. The first step in an action, process or operation is the beginning. The term is used of a definite moment in time, *e.g.* ***a*** life begins and ends (life occupies a definite period of time for an individual); ***b*** boiling begins when bubbles of vapour are formed throughout the liquid (the process is brought into being at an observable moment in time) □ *the temperature began to rise; the temperature began rising.* **2** (*v.t.*) To cause to begin. —***beginning*** (*n.*) ↓ END (Cn) ↑ START

AD024 commence (*v.t.,i.*) To begin. **Commence** and **begin** are very similar in meaning except that commence is more formal and implies a specific action □ *he commenced studying* —***commencement*** (*n.*) ↓ CONCLUDE (Cn) ↑ START

AD025 initiate (*v.t.*) To cause to start, by an agent (the initiator), which then has no further part in the action, *e.g.* ultra-violet light decomposes chlorine molecules to chlorine atoms; the chlorine atoms react with hydrogen molecules to form hydrogen chloride and hydrogen atoms; the hydrogen atoms react with chlorine molecules to form hydrogen chloride and chlorine atoms; the process continues in a chain reaction; the original chlorine atoms (formed by u.v. light) initiate the chain reaction, but thereafter have no part in the reaction. —INITIATOR, ***initiation*** (*n.*) ↑ START → INHIBIT (Cn) · TERMINATE (*n.*)

AD026 stop (*v.t.,i.*) ; o go, or to cause to go, from action to inaction; the disposition to inaction is also implied, *e.g.* ***a*** when it is no longer heated, water stops boiling (it goes from action to inaction); ***b*** stop the engine (the engine is caused to go from action to inaction); ***c*** we stopped heating before we added the iodine (action to inaction on heating). ↑ START (Cn)

AD027 end (*v.t.,i.*) **1** (*v.t.*) To cause a state of affairs to exist no longer, *e.g.* heavy rain ended the drought. **2** (*v.i.*) (Of a state of affairs) to exist no longer, *e.g.* ***a*** the experiment ended with an explosion; ***b*** I shall leave the laboratory when the experiment ends. **3** (*v.i.*) (Of objects) to reach a limit, *e.g.* the animal's tracks end here. The focus of the term is on the state of affairs not being likely to exist again, *e.g.*the school term ends in December (the same school term cannot exist again). —***end, ending*** (*n.*) ↑ START · BEGIN (Cn)

AD028 finish (*v.t.*) To bring a process or a sequence of events to completion, with the focus on the ending of the process, *e.g.* ***a*** he finished the preparation of magnesium oxide before he used it to make magnesium nitrate; **b** the experiment was easily finished in three hours. Contrast **finish** and **stop**: ***a*** he finished making the engine (the engine was complete, ready for use, and he stopped work); ***b*** he stopped making the engine (he stopped work, and as finishing was not mentioned, it is implied that the engine was not complete). —***finish*** (*n.*) ***finished*** (*adj.*) ↑ START

AD029 conclude (*v.t.*) To finish a process or a sequence of events with a specific action, with the focus on the action which finishes the process, *e.g.* Thomson concluded his experiments on the nature of positive rays by studying the double lines formed by neon. —***conclusion*** (*n.*) ↑ START · COMMENCE (Cn)

AD030 terminate (*v.t.*) To stop a process or a sequence of events before sufficient time has been taken to finish it, *e.g.* ***a*** the distillation of the mixture was terminated before all the ethanol was distilled off because the supply of gas was cut off; ***b*** in an abortion a pregnancy is terminated, *i.e.* stopped before the full period of gestation. The focus is on the time being shortened. To contrast **stop, end, finish, conclude, terminate:** ***a*** the master stopped the distillation experiment because the flask cracked (focus on action); ***b*** he ended the series of experiments on distillation as he had all the information he needed (focus on no further experiments); ***c*** he finished the distillation experiment and weighed the distillate (focus on completion); ***d*** he concluded the distillation experiment by testing the purity of the distillate (focus on final stage); ***e*** he terminated the distillation experiment because other experiments needed his attention (focus on shortage of time). —***termination*** (*n.*) ↑ START

AD031 form[5] (*v.t.,i.*) **1** (*v.i.*) To come into being in place or time, *e.g.* ***a*** a magnetic field forms around an electrical conductor; ***b*** crystals formed in the solution as it cooled. **2** (*v.t.*) To cause to form; to make exist, *e.g.* ***a*** petrol forms an inflammable vapour; ***b*** a triangle is formed by three intersecting lines. —FORM, FORMATION (*n.*) ↓ CONNECT[1] · COHERE · ADHERE ↑ CAUSE · BE

AD032 connect[1] (*v.t.*) **1** To join together, *e.g.* to connect components in an electrical circuit. **2** To establish a relation between different concepts or different occurrences, *e.g.* to connect the tides with the motion of the moon (to think that the tides may be influenced by the moon). —CONNECTION (*n.*) CONNECTIVE (*adj.*) ↑ FORM[5]

AD033 cohere (*v.i.*) (Of particles of the same material or substance) to hold together, *e.g.* the particles (molecules) of water cohere. The term implies the particles cannot be separated by a large physical force. —COHESION (*n.*) ***cohesive*** (*adj.*) ↑ FORM[5]

AD034 adhere (*v.i.*) **1** To stick or to remain attached to, *e.g.* a precipitate will adhere to the side of a beaker. **2** (Of particles) to hold together when particles of different materials or substances, *e.g.* particles (molcules) of water adhere to the particles in the surface of glass. The term implies in each case that the particles can be separated

by physical force. —***adhesion*** (*n.*) ***adhesive*** (*adj.*) ↑ FORM[5]

AD035 become (*v.i.*) **(became, become)** To change from one state to another, *e.g.* ***a*** when heated strongly, blue crystals of hydrated copper (II) sulphate become white crystals of anhydrous copper (II) sulphate; ***b*** when placed in a magnetic field, a piece of iron **becomes magnetized.** ↓ EVOLUTION[1] · SURVIVOR · LIVE[1] · GROW[2] ↑ CAUSE

AD036 evolution[1] (*n.*) The process in which a gas is formed and bubbles off, *e.g.* ***a*** when dilute hydrochloric acid reacts with calcium carbonate there is a rapid evolution of gas; ***b*** when the cap is removed from a soda water bottle there is a brisk evolution of carbon dioxide (carbon dioxide is dissolved under pressure and comes out of solution when the pressure is removed) □ *a steady/brisk/rapid evolution of* ↓ EFFERVESCENCE ↑ BECOME

AD037 effervescence (*n.*) The production in a liquid of a great number of bubbles which rise to the surface of the liquid, *e.g.* ***a*** when a bottle of soda water or other carbonated drink is opened; ***b*** when zinc reacts with warm dilute sulphuric acid. —***effervesce*** (*v.*) ***effervescing, effervescent*** (*adj.*) ↑ EVOLUTION[1]

AD038 survivor (*n.*) An organism that has survived certain circumstances or conditions, *e.g.* ***a*** the survivors of the motor car accident (circumstances); ***b*** the plants which were the survivors from the drought (conditions). ↓ SURVIVAL[1] ↑ BECOME

AD039 survival[1] (*n.*) The state of surviving, *e.g.* the survival of the best adapted individuals is the basis of Darwin's theory of natural selection. ↑ SURVIVOR

AD040 live[1] (*v.i.*) To exist and to exhibit the characteristics of living organisms, *e.g.* metabolism, irritability, growth, and in most cases, reproduction. —***life*** (*n.*) ***alive, living*** (*adj.*) ↓ GROW[1] · UNFOLD · DEVELOP[1] · EVOLVE[1] · ARISE · SURVIVE · PERSIST · WITHSTAND[1] ↑ BECOME → BE · OCCUR · FIND · TOLERATE

AD041 grow[1] (*v.i.*) **(grew, grown)** (Of organisms or crystals) to increase in size, as a natural process, by means of an increase in the number and size of individual cells or particles. —GROWTH (*n.*) ***growing*** (*adj.*) ↑ LIVE[1] → CRYSTAL

AD042 unfold (*v.i.*) To open slowly and spread out, *e.g.* a bud unfolds to form a leaf. The term implies the appearance of a structure that was previously hidden. —***unfolding*** (*n.*) ↑ LIVE[1]

AD043 develop[1] (*v.i.*) **1** To go through a natural process of change with several stages, in which different parts grow or form, *e.g.* contractile roots develop on a corm; in this process, the roots first arise on the upper surface of the corm, then grow downwards, then the upper parts of the roots contract (new, previously latent, function) and pull the corm downwards; this describes four stages of change, in which new structures appear with latent functions. **2** (Of theories or ideas) to be changed in stages over a period of time. Theories of electrolysis have developed since Arrhenius postulated the existence of ions; in these theories new concepts have been formed, such as electrode potential, ionic mobility and the electrochemical series. —DEVELOPMENT (*n.*) ***developing*** (*adj.*) ↑ LIVE[1] · GROW[1] (Sn) → DEVELOP[2] · CHANGE[2] (Sn)

AD044 evolve[1] (*v.t.*) To give off a gas continuously, or to give out a form of energy continuously, *e.g.* ***a*** zinc reacts with dilute sulphuric acid (chemical process) and hydrogen is evolved; ***b*** heat is evolved in many chemical reactions. Contrast **evolve** and **give off**: evolve implies a slower rate than give off, and also continuity in the process □ *with a greater concentration of acid, hydrogen was evolved briskly* —***evolution*** (*n.*) ↑ LIVE[1] → EVOLVE[2] · GIVE OUT · GIVE OFF

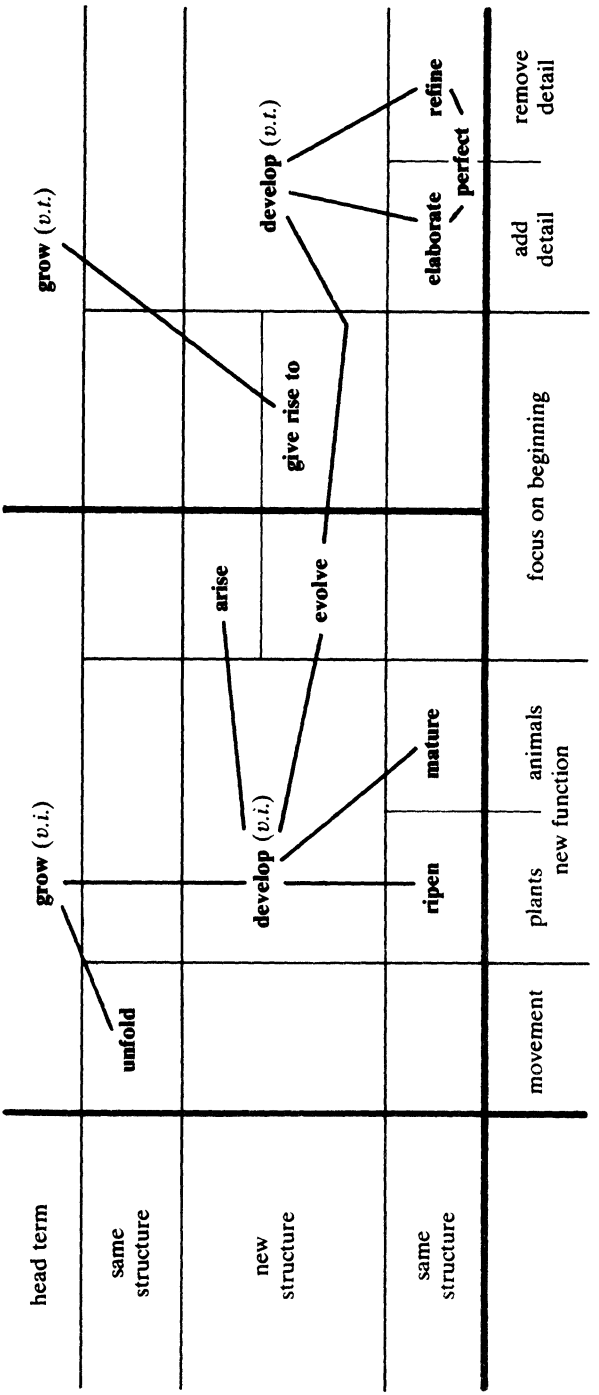
AD045 arise (*v.i.*) To come into being; to begin at a certain time or place, *e.g.* ***a*** currents arise in the endolymph of the semicircular canals (the start of the event) when the head is moved (cause or source); ***b*** eddy currents arise (start of event) in a metal conductor swinging between the poles of a magnet (cause); ***c*** contractile roots (biological structure) arise on the upper surface of corms. ↑ LIVE[1]

AD046 survive (*v.i.*) To continue to live under adverse conditions or through adverse conditions, *e.g.* ***a*** very few plants survived the severe drought (very few were alive at the end of the drought); ***b*** most fish spawn are eaten by predators—the few that survive grow to maturity. —SURVIVAL, SURVIVOR (*n.*) ↑ LIVE[1]

AD047 persist (*v.i.*) To continue to exist, or to occur again and again, in spite of efforts to remove it, or of it being unwanted, *e.g.* ***a*** some weeds persist in spite of efforts to kill them by herbicides; ***b*** in some countries, malaria persists although attempts to eradicate it have been made. —***persistence*** (*n.*) ***persistent*** (*adj.*) ↑ LIVE[1]

AD048 withstand[1] (*v.t.*) **(withstood, withstood) 1** (Of inanimate objects) to resist change caused by a force or a form of energy, *e.g.* ***a*** a concrete pillar withstands a force of compression without breaking; ***b*** tungsten can withstand a high temperature without melting. **2** (Of organisms) to be unaffected by adverse conditions, *e.g.* a cactus plant can withstand severe drought and remain alive. Note the difference between **withstand** and **survive**: a plant withstands drought, but to survive drought the plant must continue to live until the drought is ended, so although the plant can withstand drought it may not be able to survive a prolonged drought. ↑ LIVE[1] → TOLERATE

AD049 grow[2] (*v.t.,i.*) **(grew, grown) 1** (*v.i.*) (Of organisms) to develop to maturity. **2** (*v.t.*) To cause plants to grow by putting seeds in the ground and making sure that the conditions are suitable. —GROWTH (*n.*) ↓ GIVE RISE TO · EVOLVE[2] · ELABORATE[1] · REFINE[1] · PERFECT[2] ↑ BECOME



GROW & RELATED TERMS

AD050 give rise to (*v.t.*) To cause to arise, *e.g.* ***a*** the movement of the head gives rise to currents in endolymph; ***b*** the swinging of a conductor in a magnetic field gives rise to eddy currents; ***c*** the upper surface of a corm gives rise to contractile roots. The focus is on the agent or source. **Give rise to, cause,** and **produce** are compared as follows: **cause** is used for bringing effects or processes into being, *e.g.* alternating currents can cause eddy currents in a conductor. **Produce** is also used for effects and for substances and objects and implies the effect, etc., is to be used, *e.g.* ***a*** alternating currents produce eddy currents, used in an induction furnace; ***b*** petrol produces a heavy inflammable vapour. **Give rise to** is used in place of both cause and produce and often implies that the cause is an indirect one, *i.e.* there may be intermediate stages between the original cause and the final effect. ↑ GROW[2] → CAUSE (Sn) · PRODUCE (Sn)

AD051 evolve[2] (*v.t.*) To develop a plan, idea, or theory, *e.g.* to evolve a plan of investigation. ↑ GROW[2]

AD052 elaborate[1] (*v.t.*) To add fine detail to an existing process, *e.g.* to elaborate a technique for the separation of alkanes from crude oil. Contrast **develop**, in which a simple process is changed to a complex process, and **elaborate**, in which detail is added to a complex process. —ELABORATION (*n.*) ↑ GROW[2] → DEVELOP[2] (Sn)

AD053 refine[1] (*v.t.*) To remove unwanted and irrelevant detail, ambiguities, or vagueness from processes, states and concepts, *e.g.* the concept of electric current has been refined from the vague concept of fluids with particular properties, to the modern concept of a flow of electrons. —***refinement*** (*n.*) ↑ GROW[2]

AD054 perfect[2] (*v.t.*) To remove defects and faults from an object, action, process or state, *e.g.* in perfecting a technique, the technique is first elaborated, then refined, until it can be refined no further. —PERFECTION (*n.*) PERFECT (*adj.*) ↑ GROW[2]

AD055 heat (*v.t.*) To make an object or substance hot, *i.e.* not able to be touched by hand. When an object is heated its temperature is raised □ *a flask is heated strongly* —***heat, heater*** (*n.*) ↓ JACKET · BURN · BOIL[1] · INFLAMMABLE · LAGGED → CAUSE

AD056 jacket (*n.*) A surrounding protection which may be used for lagging. It usually has a special shape and may be made to fit a particular vessel. The term is also used of any container surrounding a piece of apparatus, *e.g.* ***a*** the water jacket of a condenser; ***b*** a jacket containing a vapour to maintain a high temperature. ↑ HEAT ↓ LAGGED

AD057 burn (*v.i.*) **(burnt** *or* **burned)** To be in a state of producing flame, heat, and often smoke. Something is usually consumed (used up). Burning requires substances or material which will take fire It also requires oxygen or some other suitable oxidising agent (oxidant). Most frequently things burn in air using the oxygen of the air. There is a chemical reaction implied, *e.g.* phosphorus burns in air (phosphorus combines with oxygen). —***burn*** (*n.*) ↓ IGNITE · WARM · CHAR · GLOW[1] · EXTINGUISH ↑ HEAT

AD058 ignite (*v.t.,i.*) **1** (*v.t.*) To set on fire. **2** (*v.i.*) To begin to burn. —***ignition*** (*n.*) ↑ BURN

AD059 warm (*v.t.*) To supply only sufficient heat to raise the temperature so that a solid or liquid can be touched without pain or discomfort. Compare **heat** where the temperature produced is high enough to cause pain when the heated object is touched. —***warmth*** (*n.*) ***warm*** (*adj.*) ↑ BURN

AD060 char (*v.t.*) **(charred)** To change to carbon, either by heating or by the action of a powerful dehydrating agent, *e.g.* ***a*** cane sugar (sucrose) when strongly heated is charred to a black mass of carbon; ***b*** sucrose when mixed with concentrated sulphuric acid is also charred to a black mass of carbon; ***c*** when acted upon by hot concentrated sulphuric acid, ethanol shows evidence of charring, *i.e.* it chars. —***charred*** (*adj.*) ↑ BURN

AD061 glow[1] (*v.i.*) To give out light because of heat or a chemical reaction producing heat, *e.g.* ***a*** a piece of iron glows when heated to 1000°C; ***b*** when hydrogen is passed over heated copper oxide the whole mass glows as the reaction takes place; ***c*** a piece of charcoal glows when heated in air or oxygen to 700°C (approx.); chemical reaction also takes place as the charcoal is converted to carbon dioxide. —GLOW (*n.*) ***glowing*** (*adj.*) ↑ BURN

AD062 extinguish (*v.t.*) To stop a fire, or to stop a flame burning, *e.g.* a lighted splint is extinguished if placed in carbon dioxide. —EXTINCTION, ***extinguisher*** (*n.*) ↑ BURN

AD063 boil[1] (*v.t.,i.*) **1** (*v.i.*) (Of a liquid) to change from a liquid to a gas at the boiling point, *i.e.* at the temperature at which the vapour pressure is equal to the external pressure and bubbles of vapour form throughout the liquid, *e.g.* water boils at 100°C. **2** (*v.t.*) To cause a liquid to boil. ↓ BUBBLE[1] ↑ HEAT → BOILING POINT · BOIL[3]

AD064 bubble[3] (*v.i.*) To form bubbles, as in boiling water; sometimes used of the sound made when a liquid is bubbling □ *the liquid was bubbling as the gas came off* —BUBBLE (*n.*) ***bubbling*** (*adj.*) ↑ BOIL[1]

AD065 inflammable (*adj.*) Describes materials or substances which easily take fire and produce flame, *e.g.* ether is an inflammable substance □ *a highly inflammable substance* —***inflammability*** (*n.*) ↓ NON-INFLAMMABLE (I) · FLAMMABLE · CONSUMED · SUPERHEATED[1] ↑ HEAT

AD066 non-inflammable (*adj.*) Describes materials which do not take fire and produce flame, *e.g.* asbestos is a non-inflammable solid. ↑ INFLAMMABLE (I)

AD067 flammable (*adj.*) Inflammable; the term is often used in technical literature. —***flammability*** (*n.*) ↑ INFLAMMABLE (Sn)

AD068 consumed (*adj.*) Completely

used up; converted completely into some other form. —***consume*** (*v.*) ↑ INFLAMMABLE

AD069 superheated[1] (*adj.*) **1** Heated above the boiling point without boiling taking place, *e.g.* superheated water is produced under pressure. **2** Heated further, *e.g.* superheated steam is producing by heating the steam above 100°C. —***superheat*** (*v.*) ↑ INFLAMMABLE

AD070 lagged (*adj.*) Covered, to prevent the loss of heat to the surroundings or the gain of heat from the surroundings. —LAG (*v.*) LAGGING (*n.*) ↑ HEAT

Constitution

AE001 whole (*n.*) A piece of matter, object, configuration, sequence, or process, that is complete in itself, *e.g.* ***a*** the whole of the apparatus used for distillation; ***b*** the whole of the electrical circuit used to determine the resistance of a resistor; ***c*** the whole of the circulatory system of a mammal consists of two parts, the pulmonary circulation and the systemic circulation □ *the whole of the magnetic flux remains in the laminated core* —***whole*** (*adj.*) ↓ PART (I) · COMPONENT[3] · AGGREGATE[1] · INCLUDE · SEPARATE[2] · ESSENTIAL · SEPARATE[3] · INCLUSIVE ↑ SPACE

AE002 part (*n.*) **1** Any organ or external feature of an organism which can be recognized separately, *e.g.* an arm, the chest, and a finger are all parts of the body. **2** Any one of several objects or quantities, not necessarily equal, which together make up a whole, *e.g.* ***a*** a carbon atom is part of a molecule of carbon dioxide; ***b*** part of the energy used by a machine is used in overcoming friction; ***c*** a kidney is divided into two parts, a cortex and a medulla. The use of part implies it cannot easily be separated physically from the whole, *i.e.* the division is a theoretical one and not a physical or actual one. **3** A share with others in an action or process, *e.g.* the part played by an enzyme in a biochemical reaction □ *the part played by an indicator in a titration; several types of bacteria take part in the nitrogen cycle; the catalyst has an important part in the Haber process; a diode can take the part of a rectifier in a circuit* —***part*** (*v.*) ***partly*** (*adv.*) ↓ PORTION (Sn) · DETAIL ↑ WHOLE (I) → SHARE · INCLUDE

AE003 portion (*n.*) One of several quantities, usually but not necessarily equal, into which a whole is physically divided, *e.g.* ***a*** dividing a filtrate into three equal portions; ***b*** dividing a solid product into four portions. The use of portion implies that the whole is readily divided physically for a particular purpose, *e.g.* testing each portion separately with a different test. —***apportion*** (*v.*) ↑ PART (Sn) · WHOLE (I)

AE004 detail (*n.*) A small part or a small feature of an object, process, individual, sequence or configuration; the parts or features are not necessarily equally important, *e.g.* ***a*** details of the external features of an animal include the various parts of the body, and their location, colour, size, covering tissues, and structural tissues; the amount of detail given in a description can vary depending on what is required; ***b*** details of an experiment (a process) include a description of the apparatus and a full account of the operations carried out, including any special conditions. □ *in detail; minor details are left out of a brief description; essential details must be included in a description* —***detail*** (*v.*) ***detailed*** (*adj.*) ↑ PART

AE005 component[3] (*n.*) A part of a structure or system which with other parts ensures the function of the whole, *e.g.* ***a*** the components of an electrical circuit include cells, resistors, switches and galvanometers; ***b*** a machine has components (or component parts). ↓ INGREDIENT · CONSTITUENT[1] · ITEM · MEMBER ↑ WHOLE

AE006 ingredient (*n.*) One of a number of substances or other items used to make a mixture or present in a mixture. The substances are called ingredients before mixing. After mixing they are **constituents** of the mixture. ↑ COMPONENT[3]

AE007 constituent[1] (*n.*) A part of a mixture after mixing has taken place; the substances in a mixture are its constituents. Compare **ingredients**, the substances assembled to prepare the mixture. —CONSTITUENT (*adj.*) ↑ COMPONENT[3]

AE008 item (*n.*) A single object, unit or individual in a list or collection, *e.g.* a collection of leaves in a biological study contained six items. —***itemize*** (*v.*) ↑ COMPONENT[3] → TERM · UNIT

AE009 member (*n.*) A single unit or an individual belonging to a set, group, class, or other collection of objects, organisms or items, *e.g.* ***a*** the number 4 is a member of the set of even numbers; ***b*** a horse is a member of the class of mammals; ***c*** chlorine is a member of the family of halogens ↑ COMPONENT[3]

AE010 aggregate[1] (*n.*) The sum of distinct individuals or objects in a group or collection having regard to the effect of the result, *e.g.* the aggregate of marks in all subjects must be greater than 500 for the candidate to pass (a collection of marks is used, and the result has a definite effect). —AGGREGATE (*v.*) ***aggregated*** (*adj.*) ↓ CONTENT ↑ WHOLE

AE011 content (*n.*) That which is contained in something, *e.g.* ***a*** the vitamin content of soya bean is high; ***b*** the solid content of the

mixture is 60%. ↑ AGGREGATE[1]

AE012 include (*v.t.*) To contain as a member of a class or to contain as a part of a whole, *e.g.* ***a*** the metals include copper; ***b*** a switch is included in the electrical circuit. —***inclusion*** (*n.*) ***includible, inclusive*** (*adj.*) ↓ COMPRISE · MIX ↑ WHOLE → exclude (I) · INCLUSIVE · CONSIST OF · CONTAIN

AE013 comprise (*v.t.*) To be made up of; to consist of; to include in a class or category; to contain as parts of a whole, *e.g.* ***a*** halogens comprise fluorine, chlorine, bromine, iodine; ***b*** the genus *Equus* comprises horses, mules, asses, zebras. When using **comprise**, all members of the class or category must be stated; compare **include**, where one member is shown to be in the class or category. ↑ INCLUDE

AE014 mix (*v.t.,i.*) **1** (*v.t.*) To put ingredients together to make a mixture. **2** (*v.i.*) (Of ingredients) to come together to form a mixture, *e.g.* petrol and air mix in the carburettor of an engine. —***mix*** (*n.*) ↓ SEPARATE[2] (An) ↑ INCLUDE

AE015 separate[2] (*v.t.,i.*) **1** (*v.t.*) To divide a mixture into its constituents or to remove one constituent from a mixture, *e.g.* ***a*** to separate a mixture of hydrocarbons by distillation; ***b*** to separate octane from a hydrocarbon mixture. **2** (*v.t.*) To set apart or keep apart, *e.g.* to separate two solutions by a semipermeable membrane. Here the focus is on the agent that keeps them apart (the membrane). **3** (*v.i.*) To come apart; to become separated, *e.g.* ***a*** a mixture of phenol and water separates as the temperature is lowered; ***b*** a substance may separate from solution as a precipitate. —SEPARATE (*adj.*) SEPARATION (*n.*) ↑ WHOLE

AE016 essential (*adj.*) Any part of a whole is essential if, when removed, the identity of the whole is destroyed, *i.e.* the whole can no longer be identified, *e.g.* a wick is essential to a candle (if the wick is removed, only a block of paraffin wax is left, which cannot be identified as a candle) □ *essential to* (Note: *very* cannot be used with essential; a part is either essential or not.) —***essentially*** (*adv.*) ↓ CONSTITUENT[3] ↑ WHOLE → NECESSARY

AE017 constituent[3] (*adj.*) Describes a substance which is a constituent of a mixture, or describes an atom combined in a compound, *e.g.* a constituent atom is a component of the molecule. ↑ ESSENTIAL

AE018 separate[3] (*adj.*) Describes the state of forms of matter or of organisms, or of activities when they exist apart as units in time or space, *e.g.* ***a*** separate laboratories are used for physics and chemistry; ***b*** separate experiments are carried out on photosynthesis to determine the necessary conditions □ *the chemistry laboratory is separate from the physics laboratory* ↓ SEPARABLE · SEPARATED · DISCONTINUOUS ↑ WHOLE → DIFFERENT · DISTINCT · DIVERGENT · DISPARATE

AE019 separable (*adj.*) Describes any part of a whole that can be separated, *e.g.* isotopes of elements are separable by mass spectrometry. ↑ SEPARATE[3]

AE020 separated (*adj.*)Describes a part or parts that has been removed from a whole, *e.g.* when petrol and water are put in a separating funnel, water is drawn off; water is the separated fraction. ↑ SEPARATE[3]

AE021 discontinuous (*adj.*) Describes matter with boundaries in space and separated from other pieces of matter, *e.g.* at the grain boundary of a metal crystal, the crystal structure is discontinuous and the grain boundary is a discontinuity in the arrangement of the metal ions. ↑ SEPARATE[3] → CONTINUOUS (I) · DISCRETE

AE022 inclusive (*adj.*) Describes a class, group, or whole, which contains a specified member or part, *e.g.* ***a*** the alkali metals are inclusive of lithium; ***b*** the listed components of the electrical circuit are inclusive of switches; ***c*** the kingdom of Protozoa is inclusive of bacteria. Note the difference between **inclusive** and **included**: bacteria are included in the kingdom of Protozoa □ *the category of metals is inclusive of antimony* ↓ EXCLUSIVE (I) · COLLECTIVE ↑ WHOLE

AE023 exclusive (*adj.*) Describes a class, group or whole which does not contain a specified member or part, *e.g.* the listed components of the electrical circuit are exclusive of the necessary amount of wire to connect the components, *i.e.* the wire is excluded from the list of components □ *the category of non-metals is exclusive of arsenic* ↑ INCLUSIVE (I)

AE024 collective (*adj.*) Describes the name for a category of objects or organisms, *e.g.* ***a*** alkane is the collective term for saturated aliphatic hydrocarbons of the general formula C_nH_{2n+2}, ***b*** appendage is a collective term for the chief structures arising from the trunk of an organism. ↑ INCLUSIVE → CATEGORY

Movement

AF001 travel (*v.i.*) **(travelled)** To move from one point in space to another point, *e.g.* ***a*** the earth travels in its orbit round the sun in accordance with the laws governing gravitational attraction; ***b*** light waves travel in straight lines; ***c*** a neutron travels along a path. The focus is on the moving object and not on the conditions determining its path. Contrast **guide** in which the focus is on the conditions determining the path. ↓ DEVIATE[1] · DEVIATE[2] · RETARDATION[2] · STATIONARY · DIVERGENT · MOVE[1] · MOVE[2] · CHANGE[1] ·

ORIGINATE · GIVE OFF · DISCHARGE[1] · EXTRACT[1] · INSERT · PENETRATE → INCREASE[1]

AF002 deviate[1] (*v.i.*) To fail to conform to an expected prediction that is based on a law, principle, theory or pattern, *e.g.* ***a*** real gases deviate from Boyle's Law, *i.e.* the results do not conform to the relationship between pressure and volume at high pressures; ***b*** in a series of readings of potential difference and current in the measurement of resistance, the results for the value of the resistance may deviate from its mean value because of experimental error; ***c*** a lone animal deviates from the normal pattern of behaviour of animals in a pack. —***deviation, deviant*** (*n.*) ↓ DIVERGE · CONVERGE · INCLINE · DECLINE[1] ↑ TRAVEL

AF003 diverge (*v.t.,i.*) **1** (*v.i.*) (Of two or more paths, either real or figurative, starting from a point or source) to separate continuously, *e.g.* ***a*** the paths of two balls diverge after they collide; ***b*** the paths of evolution of man and apes diverged from a common ancestor (the paths are not real paths but figurative paths). Contrast this sense of diverge with **deviate. Diverge** is used for two paths moving apart and the focus is on the separation and the continuity of the paths. For **deviate**, the focus is on the process causing deviation and implies discontinuity of the path. Deviate is used for one path moving away from another, *e.g.* the path deviated from a straight line. **2** (*v.i.*) (Of a beam of radiation) to grow wider the further it travels, *e.g.* a beam of light diverges after passing through a concave lens. **3** (*v.i.*) To move away or separate from a set path, or to become different from a standard, *e.g.* ***a*** the path of an electron may diverge from a straight line if it is deflected by a magnetic field; ***b*** the results of an experiment may diverge (become different) from the expected results if errors occur. **4** (*v.t.*) To cause to diverge, *e.g.* a concave lens diverges a beam of light. —***divergence*** (*n.*) DIVERGING, DIVERGENT (*adj.*) ↓ CONVERGE (An) ↑ DEVIATE[1]

AF004 converge (*v.t.,i.*) **1** (*v.i.*) To move closer together towards a point, *e.g.* the paths of two balls converge before they collide. **2** (*v.i.*) (Of a beam of radiation) to become narrower the further it travels, *e.g.* a beam of light converges after passing through a convex lens. **3** (*v.t.*) To cause to converge, *e.g.* a convex lens converges a beam of light. —***convergence*** (*n.*) CONVERGING, ***convergent*** (*adj.*) ↑ DEVIATE[1] · DIVERGE (An)

AF005 incline (*v.t.,i.*) **1** (*v.i.*) To be in an upwards direction from the horizontal; to slope upwards. The angle between the direction and the horizontal is the angle of inclination. **2** (*v.t.*) To cause a line or surface to slope upwards. —INCLINATION (*n.*) ***inclined*** (*adj.*) ↓ DECLINE[1] (An) ↑ DEVIATE[1]

AF006 decline[1] (*v.i.*) To be in a downward direction from the horizontal; to slope downwards. The angle between the direction and the horizontal is the angle of declination. —***declination*** (*n.*) ↑ DEVIATE[1] · INCLINE (An)

AF007 deviate[2] (*v.t.*) To make a change in the direction of the path of a radiation or a moving object, *e.g.* ***a*** a prism deviates a beam of light; ***b*** a moving ion is deviated by electric and magnetic fields. —DEVIATION (*n.*) ↓ DEFLECT · DIVERT · SHUNT[1] · REFLECT[1] ↑ TRAVEL

AF008 deflect (*v.t.*) To cause a change in direction of a moving object, stream of particles, beam of radiation, or a stationary object. The term implies an agent causing the deflection, and the focus is on the change of direction, *e.g.* ***a*** a ball is deflected on hitting a wall; ***b*** α-rays are deflected by a strong magnetic field; ***c*** a compass needle is deflected when a magnet is brought near (a change in direction of a stationary object). —***deflection*** (*n.*) ***deflected*** (*adj.*) ↑ DEVIATE[2]

AF009 divert (*v.t.*) To cause a temporary change in the path of a moving object, with the object rejoining the original path, *e.g.* an obstacle diverts an animal in search of food; the animal goes round the obstacle. —***diversion*** (*n.*) ***diverted*** (*adj.*) ↓ SHUNT[1] (H) ↑ DEVIATE[2]

AF010 shunt[1] (*v.t.*) To divert a portion of a whole from its main path to a subsidiary path, *e.g.* ***a*** to divert a portion of a train from a main line to a side track; ***b*** to divert part of an electric current from the main circuit through a resistor connected in parallel. —SHUNT (*n.*) ↑ DEVIATE[2]

AF011 reflect[1] (*v.t.*) To change the direction of light, other radiation, or moving objects by a surface or interface. The object or radiation has its general direction reversed by the surface, *e.g.* a mirror reflects light. —***reflection, reflexion*** (*n.*) ***reflected*** (*adj.*) ↑ DEVIATE[2]

AF012 retardation[2] (*n.*) **1** (Ph.) The slowing down of the motion of a body, *i.e.* decreasing its velocity; the slowing down of the rate of working of an engine. **2** (Ch.) The slowing down of a chemical action. **3** (Bio.) The slowing down of the growth of an organism. —***retard*** (*v.*) RETARDER (*n.*) ***retarded*** (*adj.*) ↑ TRAVEL → ACCELERATION (1)

AF013 stationary (*adj.*) Describes an object which is not in motion. ↓ MOTIONLESS ↑ TRAVEL

AF014 motionless (*adj.*) Describes an animal making no movements of any kind at all. The animal must also be stationary as none of its appendages are moving, *e.g.* ***a*** a predator, such as a tiger, is motionless just before it springs on its prey; ***b*** a lizard remains motionless when attacked by a bird—a bird sees any movement clearly but a motionless object is difficult for it to see. Contrast **still** and **motionless**: when an animal is still it makes small movements, such as the twitching of muscles, but when motionless, no movements at all. ↑ STATIONARY

AF015 divergent (*adj.*) Describes beams of radiation, streams of moving objects, paths, or directions, that diverge, *e.g.* ***a*** a divergent

beam of light becomes broader the further it travels; ***b*** vertebrates and invertebrates followed divergent paths of evolution. —***divergency*** (*n.*) DIVERGE (*v.*) ↓ CONVERGENT (I) ↑ TRAVEL → SEPARATE[2]

AF016 convergent (*adj.*) Describes a difference in direction such that two objects move, or two waves of a wave motion become, nearer together the more they travel, *e.g.* ***a*** a convergent beam of light becomes narrower the further it travels; ***b*** convergent paths of evolution are followed when organisms belonging to different groups develop similar characteristics. —***convergence*** (*n.*) ↑ DIVERGENT (I)

AF017 move[1] (*v.t.*) To cause a change in place or position, *e.g.* ***a*** the student moved the beaker from the tripod to the bench (a change of place); ***b*** the student moved the resistors from parallel positions to series positions (a change of positions). —***move,*** MOVEMENT (*n.*) ***moveable*** (*adj.*) ↓ TRANSFER · SHIFT[1] · REPLACE[1] · ACTUATE (Sn) · TURN[1] (Sn) · DISTURBANCE · CARRIER[3] · PORTABLE · REPLACEABLE[1] ↑ TRAVEL → MOVEMENT · MOTION · MOBILE · INTRODUCE

AF018 transfer (*v.t.*) To move matter or energy from one place to another place. The emphasis is on the original and final place and nothing is implied about the means of moving the matter or energy nor about the medium through which they move, *e.g.* ***a*** to transfer the liquid from the beaker to the flask; ***b*** transfer the electric charge from the spherical conductor to the hollow conductor; ***c*** heat is transferred by conduction, convection, or radiation from the source to the place of observation. —TRANSFER, ***transference*** (*n.*) ***transferable*** (*adj.*) ↓ TRANSPORT · TRANSLOCATE · CARRY · CONVEY (Sn) · CONDUCT · TRANSMIT ↑ MOVE[1]

AF019 transport (*v.t.*) To move matter, or energy, from one place to another using an unnamed but implied agent or instrument, *e.g.* in the higher animals oxygen is transported to all tissues from a respiratory organ (this implies a circulatory system, without stating so, but states that oxygen is moved from one place to another). —TRANSPORT (*n.*) ***transport*** (*adj.*) ↑ TRANSFER

AF020 translocate (*v.t.*) To move matter from one specified place to another by means of an unnamed, but implied agent, *e.g.* ***a*** mineral salts are translocated from the root of a plant to the leaves; ***b*** part of a chromosome is translocated into a different part of another chromosome. Note: matter is **transported** in a circulatory system, as the matter is delivered to various different places, but in **translocation** the matter is taken from one place to be delivered to a specified place □ *mineral ions are translocated from the root to the leaf* · TRANSLOCATION (*n.*) ***translocatory*** (*adj.*) ↑ TRANSFER → LOCATION

AF021 carry (*v.t.*) To move matter or energy using a named agent or named instrument, *e.g.* ***a*** a chloride ion carries electric charge equal to the charge on one electron (the ion is the agent and moves electric charge; no mention is made of the place); ***b*** oxygen is carried by the blood. —CARRIER, CARRIAGE (*n.*) ↑ TRANSFER

AF022 convey (*v.t.*) To move matter or energy from one specific place to another specific place, using a named agent or named instrument, *e.g.* ***a*** during electrolysis negative electric charge is conveyed by anions from the bulk of the solution of an electrolyte to the anode; ***b*** electric charge is conveyed from a charged conductor to an electroscope by a proof plane; ***c*** motor nerves convey impulses from the brain to muscles. —***conveyance*** (*n.*) ↑ TRANSFER

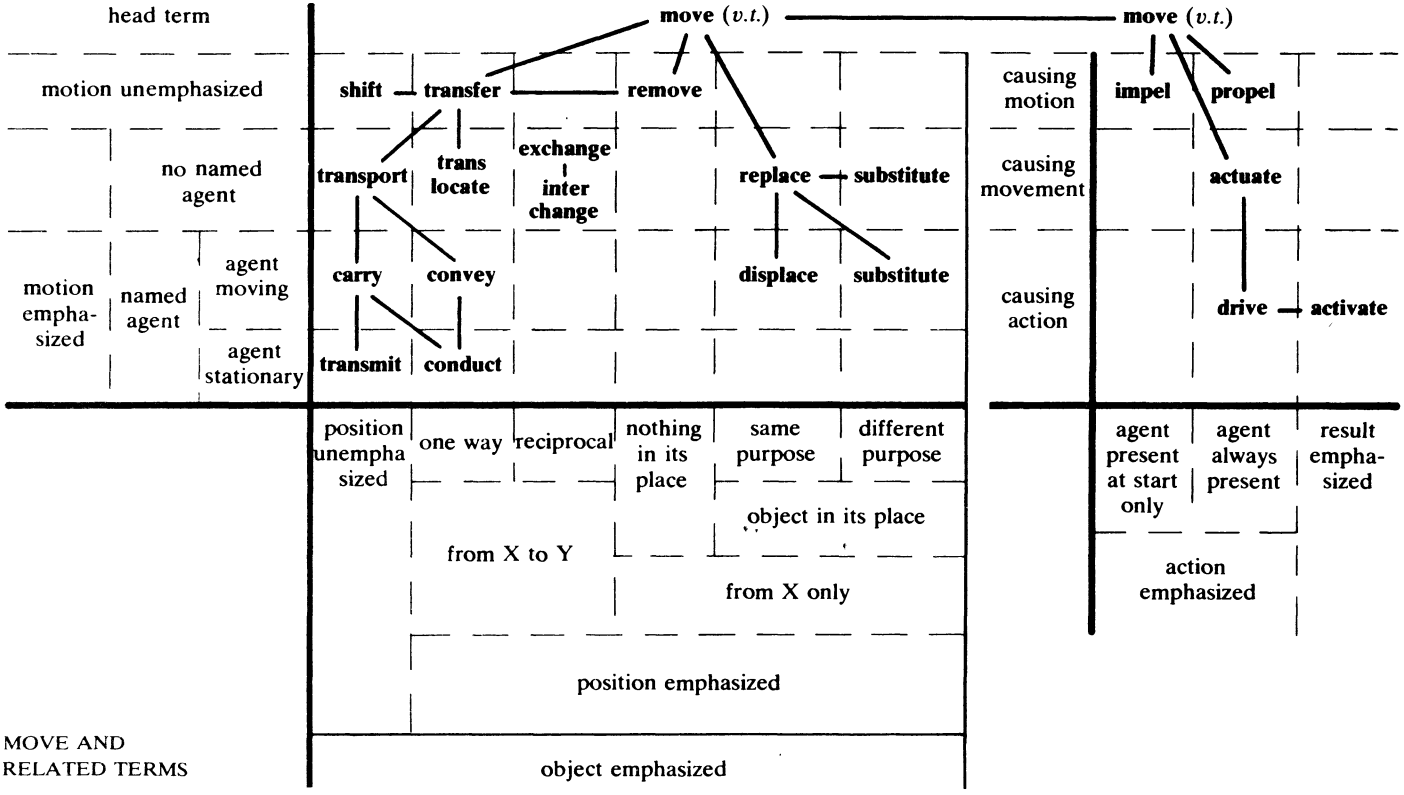
AF023 conduct (*v.t.*) To guide the flow of a fluid, electricity or heat, *e.g.* ***a*** a rubber tube conducts water from a tap to a condenser; ***b*** a pipe conducts steam from a boiler to a turbine; ***c*** a metal cable conducts electricity from a generator to a house; ***d*** copper conducts electricity. —***conducting*** (*adj.*) ↑ TRANSFER

AF024 transmit (*v.t.*) **(transmitted)** To pass on energy from point to point, through a medium; it can be a material medium (a substance) or a vacuum (*i.e.* space), *e.g.* ***a*** space (between the sun and the earth) transmits heat radiation; ***b*** a liquid transmits a pressure; ***c*** air (a material medium) transmits sound; ***d*** a shaft transmits power from the engine to the wheels of a motor car (the engine **drives** the wheels by means of the shaft, so the shaft is the means of transmitting power). —***transmission*** (*n.*) ***transmitter*** (*n.*) ***transmissible*** (*adj.*) TRANSMISSIBILITY (*n.*) ↑ TRANSFER → EMIT (Cs) · PROPAGATE

AF025 shift[1] (*v.t.*) To make a change in the position of an object without implying anything about its final position. The term implies a relatively small movement, with the emphasis on the movement or the need for the movement, *e.g.* shift the beaker away from the flame (its final position is not stated; it is a small movement). Note the following differences: ***a*** **remove** the bottle from the cupboard (the bottle is taken away from a place and nothing is put in its place); ***b*** **shift** the bottle on the shelf to make room for the beakers (a relatively small movement changes the position of the bottle; there is a need for the movement; nothing is implied about the final position); ***c*** **transfer** the bottle from cupboard A to cupboard B (the bottle is moved from one particular place to another particular place; nothing is said about the means of moving the bottle). —SHIFT (*n.*) ***shifting*** (*adj.*) ↓ REMOVE (Sn) · DISTURB ↑ MOVE[1] → POSITION

AF026 remove (*v.t.*) To move an object or an individual away from its place or position, *e.g.* ***a*** remove the cork from the bottle and pour out the liquid, ***b*** carbon dioxide is removed from the air by passing air through a solution of sodium hydroxide. —***removal*** (*n.*) ↓ REPLACE[1] (Cn) ↑ SHIFT[1] (Sn)

AF027 disturb (*v.t.*) To cause to change from a position of rest or from an orderly



MOVE AND RELATED TERMS

pattern, *e.g.* ***a*** if a stone is dropped into a bucket of water, the water surface is disturbed (its state of rest is caused to change); ***b*** in certain reversible gaseous reactions a change of pressure disturbs the equilibrium and the equilibrium shifts in the direction which tends to nullify the disturbance; ***c*** if a wave of compression passes through a gas, the molecules are disturbed, *i.e.* moved from the pattern of motion of the uncompressed gas. —DISTURBANCE (*n.*) ***disturbing*** (*adj.*) ↑ SHIFT[1]

AF028 replace[1] (*v.t.*) **1** To put an object back in its own place, *e.g.* replace the stopper in the bottle after use (the stopper is put back in its place). **2** To remove an object and put another in its place, *e.g.* replace the worn out cork with a new one. —***replacement*** (*n.*) REPLACEABLE (*adj.*) ↓ DISPLACE (Sn) · SUBSTITUTE (Sn) · EXCHANGE (Sn) · INTERCHANGE (Sn) ↑ MOVE[1]

AF029 displace (*v.t.*) To move an object or piece of matter away and take its place, *e.g.* ***a*** zinc displaces hydrogen from hydrogen chloride (hydrogen is present and zinc takes its place by pushing the hydrogen out); ***b*** an object submerged in water displaces its own volume of water (the object takes the place of the water, by pushing the water away); ***c*** air is displaced when a gas is collected in a gas-jar. —DISPLACEMENT (*n.*) ***displaceable*** (*adj.*) ↑ REPLACE[1] (Cs)

AF030 substitute (*v.t.,i.*) **1** (*v.t.*) To replace an object or matter by another object, or other matter, such that the object or matter replacing the original has a different, but not wholly different, character or nature from that of the original, *e.g.* ***a*** a long glass tube can substitute for a water-condenser in a distillation apparatus (the character and nature of the tube differ from that of the condenser; the tube is not as efficient as the condenser, but it can be used for the same purpose); ***b*** a rubber bung can substitute for a glass stopper in a graduated flask (the nature of the bung differs from that of the stopper, but their method of use is similar). **2** (*v.i.*) To be substituted for something □ *an ammeter substitutes for a galvanometer; a galvanometer is substituted by an ammeter* —***substitute,*** SUBSTITUTION (*n.*) ***substitutable*** (*adj.*) ↑ REPLACE[1] (Sn) → SUBSTITUTION

AF031 exchange (*v.t.*) To cause two different objects to change places with each other. Let object A be at place X and object B at place Y. When A and B are exchanged, A goes to Y and B goes to X, *e.g.* in ion exchange, calcium ions in hard water go to a zeolite resin in the water softener, and sodium ions go from the zeolite to the water (sodium and calcium ions are exchanged) □ *calcium ions are exchanged for sodium ions in a water softener* —***exchange*** (*n.*) ***exchangeable*** (*adj.*) ↓ INTERCHANGE (H) ↑ REPLACE[1] (Sn) · DISPLACE (Sn)

AF032 interchange (*v.t.*) To exchange identical objects, or objects with the same action, *e.g.* ***a*** diodes and copper oxide rectifiers can be interchanged from the point of view of their function of rectification; from the point of view of their ability to pass an electric current they are non-interchangeable; ***b*** when a liquid is in equilibrium with its vapour, the molecules in the liquid interchange with the molecules in the vapour □ *a flat-bottom flask cannot be interchanged for a distillation flask* —***interchange*** (*n.*) ↑ REPLACE[1]

AF033 actuate (*v.t.*) To keep an object in movement, or mechanism in operation, *e.g.* ***a*** the spring of a clock actuates the mechanism which turns the hands; ***b*** an electric current actuates the mechanism of a galvanometer and moves the pointer. —***actuation*** (*n.*) ↓ DRIVE (Sn) · IMPEL · PROJECT · PROPEL · ACTIVATE ↑ MOVE[1]

AF034 drive (*v.t.*) **(drove, driven)** To maintain an action or a process in operation, with the agent always present, *e.g.* ***a*** the engine of a motor car drives the wheels of the car by means of a driving-shaft; ***b*** maintaining a sufficiently high temperature drives to completion the reaction between potassium manganate (VII) and ethanedioic (oxalic) acid. —DRIVE, ***driver*** (*n.*) ***driving*** (*adj.*) ↑ ACTUATE

AF035 impel (*v.t.*) **(impelled)** To start an object in motion by applying a force, with the agent only starting the action, *e.g.* a force of collision impels an object along its path. —IMPULSE, ***impulsion, impellor*** (*n.*) ***impelled*** (*adj.*) ↓ PROPEL (Sn) ↑ ACTUATE

AF036 project (*v.t.*) To impel an object in a definite direction or to aim a beam of radiation in a particular direction, *e.g.* ***a*** to project a stone upwards (a force impels the stone); ***b*** to project a rocket at an angle to the horizontal, and at an angle to the equator (the direction is completely specified); ***c*** to project the image from a lens onto a screen (light, a radiation, is aimed in a particular direction). —PROJECTION, PROJECTILE, ***projector*** (*n.*) ***projective, projected*** (*adj.*) ↑ ACTUATE · IMPEL (Sn) → EJECT (Cs)

AF037 propel (*v.t.*) To maintain an object in forward motion with the agent causing the motion always present, *e.g.* a jet engine propels an aeroplane. —PROPELLER, PROPULSION, PROPELLANT (*n.*) ***propelled*** (*adj.*) ↑ ACTUATE · IMPEL (Sn)

AF038 activate (*v.t.*) To cause a substance or object to be active, *e.g.* ***a*** to activate charcoal to increase its powers of absorption; ***b*** thrombokinase activates prothrombin to form thrombin in the formation of blood clots; ***c*** a high temperature may be needed to activate molecules or atoms so they have sufficient energy to react. —***activation*** (*n.*) ↑ ACTUATE

AF039 turn[1] (*v.t.*) **1** To cause an object to change direction about a line (axis) inside its body, or about a line (axis) outside its body, *e.g* ***a*** the man turns the steering wheel of a motor car (axis in the wheel), ***b*** the mechanic turns the nut with a spanner. **2** To change the form or appearance of an object, *e.g.* ***a*** heat turns blue hydrated copper

sulphate into white anhydrous copper sulphate; ***b*** acid turns blue litmus red. Note: the term can be used as in the examples above, but there are more suitable terms that can be used, as explained below. —TURN (*n.*) ↓ ROTATE (Sn) · REVOLVE (Sn) · SPIN (Sn) · TWIST (Sn) · WHIRL ↑ MOVE[1] → CHANGE[1] (Sn) · CONVERT (Sn) · TURN[2]

AF040 rotate (*v.t.,i.*) **1** (*v.i.*) (Of a body) to turn about a line (axis) going through the body, *e.g.* ***a*** a wheel rotates about its axle; ***b*** the earth rotates about its axis. **2** (*v.t.*) To cause to rotate. —ROTATION, ROTOR (*n.*) ***rotating, rotative, rotational, rotatory*** (*adj.*) ↑ TURN[1] (Sn) ↓ REVOLVE (Sn) · SPIN (Sn)

AF041 revolve (*v.i.*) (Of a body) to turn around a point or line (axis) outside itself, *e.g.* the earth revolves around the sun. —***revolution*** (*n.*) ***revolving*** (*adj.*) ↑ TURN[1] (Sn)

AF042 spin (*v.t.,i.*) To rotate with a quick motion; to rotate with a quick motion while moving in a curved or straight line, *e.g.* ***a*** the wheels of a car spin when they slip on a wet road; ***b*** an electron, or other sub-atomic particle, possibly spins on its axis—this spinning may be responsible for its magnetic moment, ***c*** to spin a gyroscope on its axis. —SPIN (*n.*) ***spinning*** (*adj.*) ↑ TURN[1] (Sn)

AF043 twist (*v.t.,i.*) **1** (*v.t.*) To turn the end of a long straight solid while keeping the other end stationary, or to turn the opposite ends in opposite directions. **2** (*v.i.*) To become twisted, *e.g.* the beam twisted out of shape. —***twist*** (*n.*) ***twisted*** (*adj.*) ↑ TURN[1]

AF044 whirl (*v.t.,i.*) **1** (*v.i.*) To revolve at a high speed; this kind of movement is associated with a strong force and the axis of revolution may also move along a line, *e.g.* in a whirlwind, dust particles whirl into the air; the particles revolve about the axis of the whirlwind, and the axis moves over the earth. **2** (*v.t.*) To cause to revolve at a high speed. —***whirl*** (*n.*) ↑ TURN[1]

AF045 disturbance (*n.*) The state of being disturbed, *e.g.* a vibrating body compresses air molecules together; this disturbance is then transmitted as a pulse of compression. —DISTURB (*v.*) ↓ PERTURBATION · CARRIAGE · PROPULSION ↑ MOVE[1]

AF046 perturbation (*n.*) A disturbance in the regular pattern of a motion; it implies the action of a force, *e.g.* the moon in its path round the Earth may be disturbed by the gravitational field of another planet and deviate from its regular path; this deviation is a perturbation. —***perturbative*** (*adj.*) ↑ DISTURBANCE

AF047 carriage (*n.*) The process of carrying performed by an agent, *e.g.* the carriage of negative electric charge by a chloride ion in solution. ↑ DISTURBANCE

AF048 propulsion (*n.*) The action of propelling an object, *e.g.* a jet engine is used for the propulsion of an aeroplane. ↑ DISTURBANCE → PROPELLANT

AF049 carrier[3] (*n.*) The agent performing the action of carrying, *e.g.* a chloride ion in solution is a carrier of negative electric charge. ↓ PROPELLER ↑ MOVE[1]

AF050 propeller (*n.*) A rotating part with blades, of a machine, which propels a ship or an aeroplane. ↑ CARRIER[3] → PROPELLANT

AF051 portable (*adj.*) Describes a device or instrument that can be transported, *e.g.* an aneroid barometer is portable whereas a mercury barometer is not portable, *i.e.* the aneroid barometer can be moved from place to place with ease and then used. The existence of a portable type of an instrument or device implies the existence of one that is not portable. ↑ MOVE[1]

AF052 replaceable[1] (*adj.*) Describes an object that can be easily replaced. ↓ IRREPLACEABLE (I) ↑ MOVE[1]

AF053 irreplaceable (*adj.*) Describes an object that cannot be replaced, *e.g.* do not break the barometer as it is irreplaceable until next year (a broken barometer is of no use, and it is not possible to get another barometer to use instead of the broken one until next year). ↑ REPLACEABLE[1] (I)

AF054 move[2] (*v.i.*) To change place or position, *e.g.* ***a*** the man moved from one house to the other (the man changed from one place to another); ***b*** the cat moved from a sitting to a lying position (the cat changed from one position to another). —MOVEMENT (*n.*) ***moving*** (*adj.*) ↓ SHIFT[2] (Sn) · FLOW · TURN[2] ↑ TRAVEL → MOVEMENT · MOTION · MOBILE · MOTILE · WALK (Sn) · RUN (Sn) · FLY (Sn) · SWIM (Sn) · JUMP (Sn) · FALL (Sn) · SLIDE (Sn)

AF055 shift[2] (*v.i.*) (Of an object) to change position, implying a relatively small movement; the focus is on the movement and not on the position, *e.g.* in a polar bond, the electrons shift towards the atom with the greater electron attraction (the movement is small, and is a change in position without emphasis on the final position). Contrast **transfer**: an electron is transferred from one atom to another in an ionic bond (emphasis is on the final position of the electron). —***shift*** (*n.*) ↑ MOVE[2]

AF056 flow (*v.i.*) (Of a fluid, heat, or electricity) to move along a pipe or channel, or over a surface, or through a hole or medium □ *gas flows along the pipe* —***flow*** (*n.*) ↓ DRIP · TRICKLE · PERCOLATE ↑ MOVE[2]

AF057 drip (*v.t.,i.*) **1** (*v.i.*) (Of liquids) to flow in separate drops, *e.g.* water drips from a leaking joint in a pipe. **2** (*v.t.*) To cause to flow in small drops, *e.g.* to drip a liquid into a flask from a pipette. —***drip*** (*n.*) ↑ FLOW → LEAK

AF058 trickle (*v.i.*) (Of liquids) to flow slowly, in a narrow stream, *e.g.* a filtrate trickles down the stem of a glass funnel —***trickle*** (*n.*) ↑ FLOW

AF059 percolate (*v.i.*) (Of liquids) to flow slowly through the spaces in a porous solid or through the spaces in a layer of stones or large particles. —***percolation*** (*n.*) ***percolating*** (*adj.*) ↑ FLOW → OOZE SEEP

AF060 turn[2] (*v.t.*) **1** (Of a body) to move through an angle, either keeping in the same position, *i.e.* turning about a line (axis)

inside the body, or changing position, *i.e.* turning about a line (axis) outside the body, *e.g.* ***a*** the earth turns about its axis (axis inside); ***b*** the earth turns around the sun (axis outside); ***c*** the minute hand of a clock turns round once in an hour. **2** To change into another form or to change in appearance, *e.g.* ***a*** sulphur can turn from one crystalline form into another; ***b*** litmus turns blue with alkalis; ***c*** a larva turns into a pupa. —TURN (*n.*) ↓ SET[1] · DRIFT · TEND · BIAS[1] ↑ MOVE[2] → TURN[1]

AF061 set[1] (*v.i.*) To take or have a fixed direction, *e.g.* ***a*** an ocean current which sets in a North-East direction; ***b*** a compass needle sets in the direction of a magnetic field. —***set*** (*n.*) ↓ BIAS

AF062 drift (*v.i.*) **1** To be in slow motion because of an external force, *e.g.* ***a*** a boat drifts with the tide; ***b*** when an electric potential is applied to a conductor electrons drift towards the positive pole. **2** To move from a true course slowly because of a sideways force, or because of spin producing such a force, *e.g.* a projectile spinning in a clockwise direction, viewed from behind, drifts off course to the right. —***drift*** (*n.*) ↓ BIAS[1] (Cs) ↑ TURN[2]

AF063 tend (*v.i.*) **1** To have a possible effect or possible behaviour; to be disposed to some action or behaviour. The term is used for potential changes, that do not necessarily have to occur, *e.g.* ***a*** force is that which changes, or tends to change, a body's state of rest (an opposing force, such as friction, may prevent the body being moved, but if this opposing force is not present the force will move the body); ***b*** a bar magnet tends to become weaker owing to self-demagnetization (generally speaking, bar magnets grow weaker with time because of self-demagnetization). **2** (Of a dependent variable quantity) to approach a limiting value as a result of a change in the independent variable quantity, *e.g.* ***a*** as the resistance (independent variable) in a circuit is increased the current (dependent variable) tends to zero (as the resistance becomes very high the current becomes very small, *i.e.* not measurable); ***b*** the man tends to be careless (he can become careless unless checked) □ *the reaction tends to be vigorous* —***tendency*** (*n.*) ↑ SET[1]

AF064 bias[1] (*v.t.*) To cause an object to drift from its course by weighting it on one side, *i.e.* the object does not travel in a straight line; to apply a force which causes such a drift, or gives a tendency to a definite action, *e.g.* to bias the grid of an electronic valve by applying a negative potential which reduces the flow of electrons if they are attracted to the anode of the valve. —***bias*** (*n.*) ↑ TURN[1] · DRIFT (Cs)

AF065 change[1] (*v.t.*) **1** To make an essential difference to an object, configuration, state, process, quantity or quality, *e.g.* ***a*** to change the state of a substance from solid to liquid; ***b*** to change the nature of steel by tempering; ***c*** to change the course of a reaction. **2** To replace one object by another, *e.g.* change the old cork in the bottle for a new one. □ *to change one object for another; to change over to a better method of preparation* —***change*** (*n.*) ***changeable, changing*** (*adj.*) ↓ CONVERT · MODIFY · SET[2] · CHANGE[2] · TARGET[1] · PARALLEL[1] ↑ TRAVEL

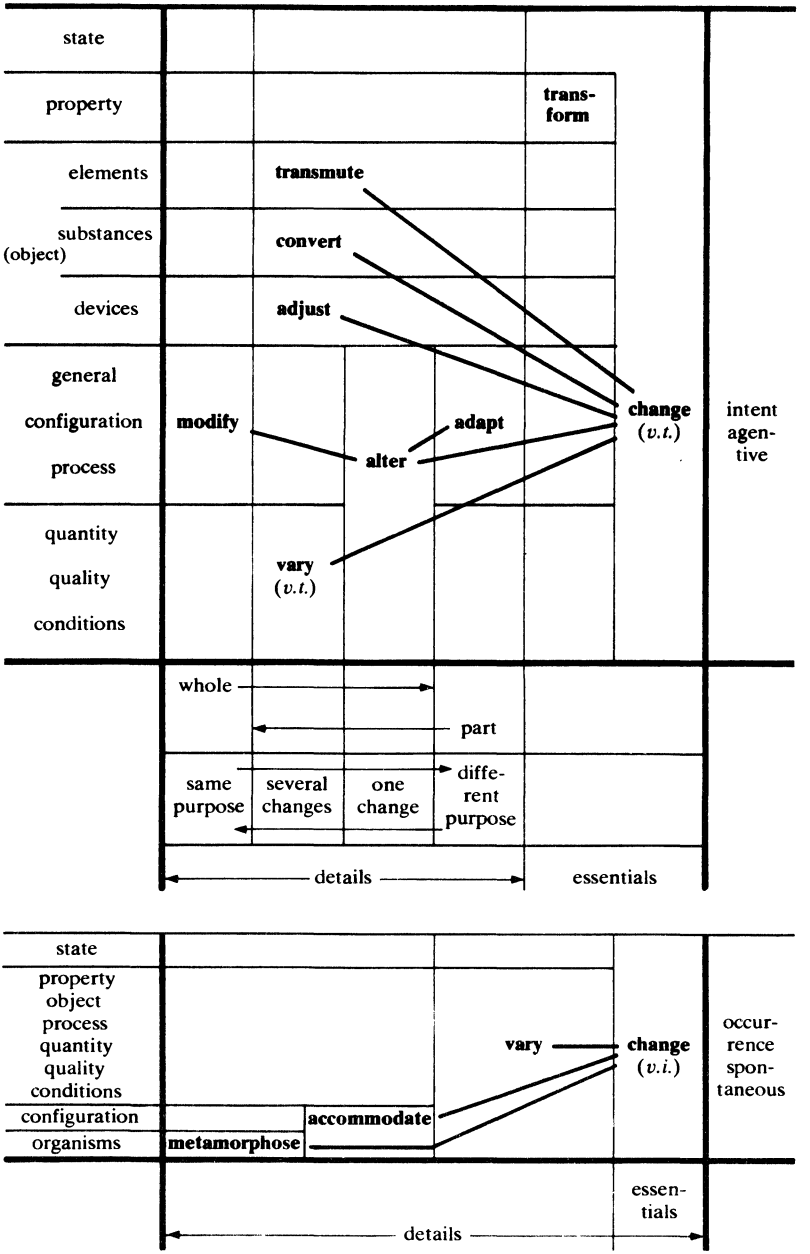
AF066 convert (*v.t.*) To change the chemical, or physical, character of matter; to change in character or function, *e.g.* ***a*** to convert water to steam; ***b*** to convert a galvanometer to an ammeter; ***c*** to convert one allotropic form of sulphur to another; ***d*** to convert ammonia to nitric acid by the catalytic oxidation of ammonia. —***converter, conversion*** (*n.*) ***convertable*** (*adj.*) ↓ TRANSFORM · TRANSMUTE · BREAK DOWN · ↑ CHANGE[1]

AF067 transform (*v.t.*) To change an entity from one form into another (the meaning of form is here restricted to a generalization of properties), *e.g.* to transform one form of energy into another form, as in transforming electrical energy into light (the properties of the entity, energy, are changed). Note: in describing changes of chemicals or of atomic structure, **convert** is used, *e.g.* rhombic sulphur is converted into monoclinic sulphur. In describing changes in the form and structure of organisms, **metamorphose** is used, *e.g.* a larva metamorphoses into a pupa. —TRANSFORMATION (*n.*) TRANSFORMER (*n.*) ↑ CONVERT → METAMORPHOSE · TRANSFORMER

AF068 transmute (*v.t.*) To change one element into another, either naturally as occurs in radioactivity, or artificially by bombarding atoms of an element with neutrons, *e.g.* magnesium is transmuted to sodium by the bombardment of neutrons. ↑ CONVERT → RADIOACTIVITY

AF069 break down (*v.t.,i.*) **(broke down, broken down)** **1** (*v.i.*) To disintegrate, decompose, or decay. A general term that does not distinguish between physical, chemical, or biological change, *e.g.* ***a*** rocks break down into small fragments owing to climatic conditions (weathering causes physical disintegration); ***b*** lead (II) nitrate breaks down on heating into lead (II) oxide and nitrogen (IV) oxide (nitrogen dioxide) (chemical decomposition); ***c*** all dead organisms break down with the formation of carbon dioxide (biological decay). **2** (*v.t.*) (Of machines and engines) to stop working, *e.g.* the electric motor broke down because the armature became too hot. **3** (*v.t.*) To cause to disintegrate or decompose, *e.g.* ***a*** bile salts break down fat into small globules (cause physical disintegration); ***b*** heating breaks down lead (II) nitrate into lead (II) oxide and nitrogen (IV) oxide (nitrogen dioxide) (causes it to decompose); ***c*** lipase breaks down fat into glycerol and a fatty acid (chemical decomposition). ↑ CONVERT → DISTINTEGRATE · DECOMPOSE · DECAY

AF070 modify (*v.t.*) To alter an object, configuration or process to restrict its use for a particular purpose. Modify implies



CHANGE & RELATED TERMS

that the purpose of the object, configuration or process is not basically changed, but only restricted and that the alterations affect the whole, not just a part, *e.g.* a distillation apparatus is modified for use with steam distillation. —***modification*** (*n.*) ***modifiable*** (*adj.*) ↓ ALTER[1] (Sn) · ADJUST · VARY[1] (Sn) · ADAPT (Sn) · ACCOMMODATE ↑ CHANGE[1]

AF071 alter[1] (*v.t.*) To make a difference in detail but not in essential characteristics, so that there is no change of identity of an object, configuration or process, *e.g.* ***a*** alter the temperature of the reaction from 20°C to 50°C; ***b*** when rhombic sulphur is converted to monoclinic sulphur, the configuration of the sulphur molecules in the crystal structure is altered. —***alteration*** (*n.*) ↑ MODIFY (Sn)

AF072 adjust (*v.t.*) To make a small alteration in a device, mechanism, process or instrument to make it function or to improve its function. The term also implies the correction of a fault, *e.g.* ***a*** adjust the objective lens of a microscope to bring an object into focus (make a small change in the position of the objective lens); ***b*** adjust a terminal which has a loose contact (correct a fault). —***adjustment*** (*n.*) ***adjustable*** (*adj.*) ↑ MODIFY

AF073 vary[1] (*v.t.*) To make a difference in a quantity, quality or conditions. The term implies that a set of different quantities or conditions is used, *e.g.* to vary the temperature of the gas and measure its volume at each of the different temperatures; ***b*** to vary the conditions to determine those favouring the germination of seeds. —VARIATION, VARIABLE (*n.*) ***variable*** (*adj.*) ↑ MODIFY

AF074 adapt (*v.t.*) To alter a part of, or to add a part to, an object, configuration, or process, so that it becomes more suitable for a purpose other than its original purpose, or so that it meets new conditions, *e.g.* a wide-mouth flask is adapted to form a refluxing apparatus by joining the flask to a condenser with an adaptor. —***adaptor*** (*n.*) ***adaptable*** (*adj.*) ↑ MODIFY (Sn) → CONFORM · RECONCILE · ADAPTATION

AF075 accommodate (*v.t.*) (Of an organism or structure) to adjust to the environment, *e.g.* the eye accommodates to objects in its environment by adjusting the focal length of the crystalline lens, bringing the object into focus on the retina. Note. a part is adjusted so that the whole becomes accommodated —ACCOMMODATION (*n.*) ↑ MODIFY

AF076 set[2] (*v.t.*) **1** To fix the position, place, direction or value of a variable quantity, by changing the position, place, direction or value to that which is required for a definite purpose, *e.g.* ***a*** to set the variable resistor to produce a current of 5 A in the circuit, ***b*** to set the plane of the coil in the magnetic meridian. **2** To start an action which then continues, *e.g.* ***a*** set the pendulum swinging, ***b*** set the magnesium alight by applying a flame □ *a force sets a body in motion, a group of objects correctly arranged is set in order; when zinc acts in hydrochloric acid, hydrogen is set free; ethanol heated in a basin is easily set on fire* —***setting*** (*n.*) ***set*** (*adj.*) ↓ AIM · DIRECT · ORIENT ↑ CHANGE[1] → SET UP

AF077 aim (*v.t.*) To point a device after making a careful estimation. The device may either be for propelling or impelling objects, or for emitting radiation or energy. The estimation is needed to make sure that the object or radiation arrives at a chosen point, *e.g.* ***a*** to aim an electron gun at an X-ray target; ***b*** to aim a hose-pipe at a house, so that a jet of water from the pipe is directed onto the house □ *a gun is aimed at a target* —***aim*** (*n.*) ↑ SET[2]

AF078 direct (*v.t.*) To aim a source of a jet of fluid, or a stream of radiation or energy, so that the fluid, radiation, or energy arrives at a chosen point or area (the **target**). It is the fluid or the radiation that is directed when the source is aimed, *e.g.* ***a*** to direct a jet of water at a burning fire; ***b*** to direct a beam of light at a mirror or an instrument; ***c*** to direct the flame from a blow-lamp onto a glass surface □ *direct a beam of light at a target; direct a beam of light onto a house; direct a beam of light towards a house* —DIRECTION (*n.*) ↑ SET[2]

AF079 orient (*v.t.*) To place an object in a certain direction in relation to an accepted reference or direction, *e.g.* ***a*** to orient a map so that geographical north on the map coincides with the geographical meridian; ***b*** to orient a magnetic coil with its plane at right angles to the magnetic meridian. —***orientation*** (*n.*) ***oriented*** (*adj.*) ↑ SET[2] (Sn)

AF080 change[2] (*v.i.*) (Of an object, substance, configuration, state, process quality, quantity or organism) to undergo a process in which a difference arises, either in essentials or details, *e.g.* when a solid melts it changes from a solid to a liquid □ *a pupa* changes into *an adult* —***change*** (*n.*) ***changeable*** (*adj.*) ↓ ALTER[2] · VARY[2] · FLUCTUATE ↑ CHANGE[1] → CONVERT · METAMORPHOSE

AF081 alter[2] (*v.i.*) To become different in detail but not in essential characteristics, so that there is no change in identity of an object, configuration, process, quality, or quantity, *e.g.* ***a*** the resistance of a piece of wire alters with a change in temperature (only one change, of resistance) —***alteration*** (*n.*) ↑ CHANGE

AF082 vary[2] (*v.i.*) Describes a process by which a difference in detail only arises in an object, configuration, quantity, quality, or between organisms, *e.g.* ***a*** the atmospheric temperature varies from day to day; ***b*** the green colour of leaves varies from one species of a plant to another; ***c*** the size of seeds varies for individual plants of the same species. It can also imply a difference from the normal or the usual, *e.g.* ***a*** the normal temperature of a human being is 37°C but a person's temperature can vary between 36°C and 40°C; ***b*** the normal

voltage of the supply from the mains electrical supply is 240 V, but this voltage may vary above and below this value. —***variation*** (*n.*) ***variety*** (*n.*) ***variant*** (*n.*) ***varying*** (*adj.*) ↑ CHANGE[2]

AF083 fluctuate (*v.i.*) To vary above and below an expected value of a physical quantity, or of a number, in an uneven and irregular manner, *e.g.* in a humid hot country the temperature fluctuates about a mean value. —***fluctuation*** (*n.*) ***fluctuating*** (*adj.*) ↑ VARY[2]

AF084 target[1] (*n.*) The chosen point or area at which a device is aimed, or at which a jet of fluid or stream of radiation is directed. ↓ DIRECTION · ANGLE ↑ CHANGE[2]

AF085 direction[1] (*n.*) **1** The straight line between a source or origin and a target. **2** The action or function of directing. ↑ TARGET[1]

AF086 angle (*n.*) A measure of a change in orientation. It is usually measured as the amount of turning about a point of a line or plane. ↑ TARGET[1]

AF087 parallel[1] (*adj.*) Describes two straight lines or two plane surfaces, or a line and a plane surface, which are at the same distance throughout their length or area, *e.g.* ***a*** straight railway lines are parallel to each other; ***b*** the top and bottom surfaces of a rectangular box are parallel to each other. —***parallelism*** (*n.*) ↓ PERPENDICULAR · OBLIQUE · SKEW · VERTICAL · HORIZONTAL · NORMAL[2] · TILTED ↑ CHANGE[2]

AF088 perpendicular (*adj.*) Describes a straight line which makes an angle of 90° with another straight line or with a plane surface. It also describes a plane surface which makes an angle of 90° with another plane surface, *e.g.* ***a*** the walls of a room are perpendicular to the floor; ***b*** two straight lines on a graph can be perpendicular to each other □ *line AB is perpendicular to line CD* —***perpendicular*** (*n.*) ↑ PARALLEL[1]

AF089 oblique (*adj.*) Describes a straight line which meets another straight line or a plane surface at an angle other than 90°, *e.g.* two straight lines on a graph inclined at 30° to each other are oblique lines □ *the two lines are oblique* ↑ PARALLEL[1]

AF090 skew (*adj.*) Describes two straight lines which are not parallel to each other drawn in three dimensions so that they never meet however far they are lengthened. ↑ PARALLEL[1]

AF091 vertical (*adj.*) Describes the direction, at any point on the Earth, which points towards the centre of the Earth. If a heavy mass is suspended on a piece of string, the string takes up a vertical position when at rest. —***vertical*** (*n.*) ↑ PARALLEL[1]

AF092 horizontal (*adj.*) Describes a direction perpendicular to a vertical direction, *e.g.* the surface of water in a container is horizontal. —***horizontal*** (*n.*) ↑ PARALLEL[1]

AF093 normal[2] (*adj.*) Describes a straight line which is perpendicular to a plane or to another line, *e.g.* ***a*** a vertical line is drawn normal to a horizontal plane, ***b*** any line drawn through the centre of a circle is normal to the circumference. —***normal*** (*n.*) ↑ PARALLEL[1]

AF094 tilted (*adj.*) Describes a surface which is inclined to the horizontal, *e.g.* a table lifted at one end is tilted. ↑ PARALLEL[1]

AF095 originate (*v.t.,i.*) **1** (*v.i.*) To come from an origin, *e.g.* the energy in coal originates from the sun (the sun was the original source of the energy, used to make plants grow; the plants later were converted into coal). **2** (*v.i.*) (Of theories and ideas) to develop from a starting point, *e.g.* the hypothesis of the electron originated in J. J. Thomson's experiments. **3** (*v.t.*) To invent or start a theory or idea, *e.g.* to originate an atomic theory. —***originator*** (*n.*) ↓ EMIT · DERIVE[3] · ISSUE ↑ TRAVEL

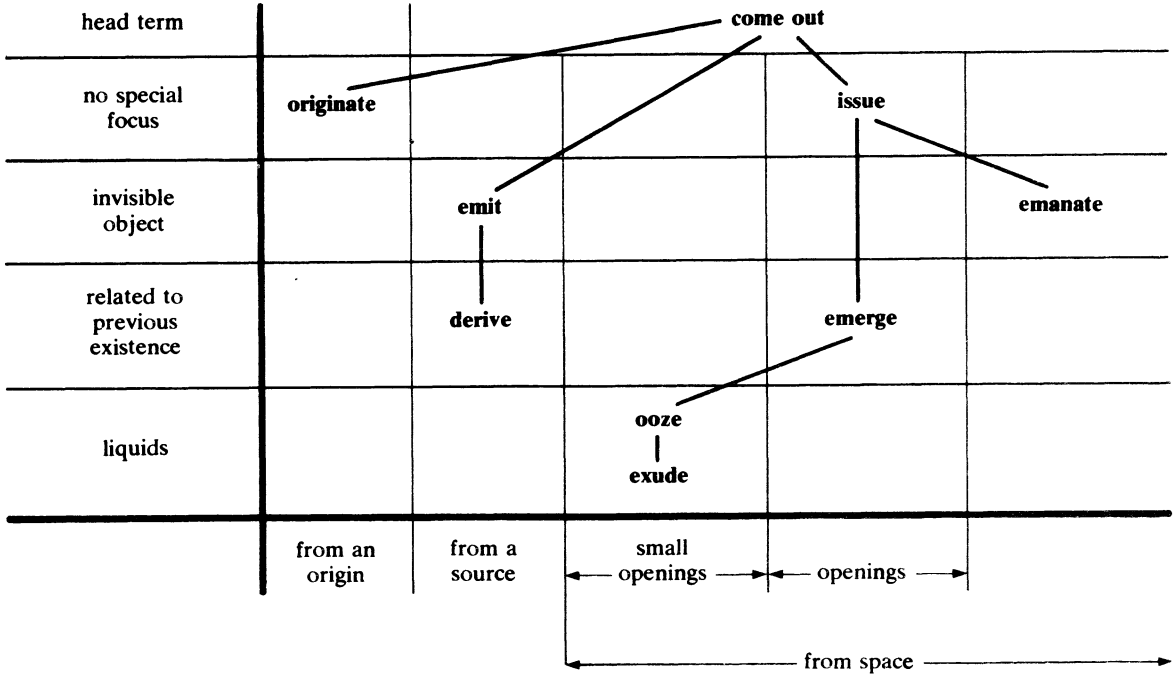
AF096 emit (*v.t.*) To give out from a source energy, light, radiation, matter, sound, gas or odour, *e.g.* ***a*** a heated filament emits electrons; ***b*** a gong emits sound waves when struck; ***c*** certain sweat glands emit a distinctive odour when an animal is frightened. Contrast **emit** and **evolve**: emit implies that no agent is required, *e.g.* a volcano emits clouds of sulphur dioxide. Evolve implies a process with an agent, *e.g.* hot concentrated sulphuric acid on copper evolves sulphur dioxide. —***emission,*** EMITTER (*n.*) ***emitted*** (*adj.*) ↑ ORIGINATE

AF097 derive[3] (*v.t.,i.*) **1** (*v.t.*) To obtain or develop from another form or from a related material or related organism, *e.g.* ***a*** electrical energy is derived from heat; ***b*** benzene carboxylic acid is derived from toluene (methyl benzene) (obtained from toluene by reaction; the chemical structures are related); ***c*** the wing of a bird is derived from the forelimb of its prehistoric ancestors (indicates the evolutionary descent of the wing). **2** (*v.i.*) To be derived, *e.g.* benzene carboxylic acid derives from methyl benzene. —***derivation*** (*n.*) ***derivative*** (*n.*) ***derived*** (*adj.*) ↑ ORIGINATE

AF098 issue (*v.t.*) To come out or to flow out from a place, the term usually implies coming out of an opening, *e.g.* wait until steam issues freely before connecting the apparatus □ *water issues from a tap* —***issue*** (*n.*) ↓ EMANATE (Sn) · EMERGE (Sn) · OOZE · EXUDE ↑ ORIGINATE

AF099 emanate (*v.i.*) (Of a form of energy, a gas, or anything invisible) to come from a source, *e.g.* radon gas emanates from radium when it undergoes radioactive decay. —***emanation*** (*n.*) ↑ EMIT (Sn) · ISSUE

AF100 emerge (*v.i.*) (Of an object, organism or radiation) to come out from being hidden or out of sight without any change of form, *e.g.* ***a*** a butterfly imago emerges from its pupal case (the imago is fully developed, hence no change of form); ***b*** a ray of light emerges from a glass block **2** (Of an idea or abstract relation) to become known or understood, *i.e.* the idea was hidden but is now clear, *e.g.* the relation between sunlight and photosynthesis emerges from studying the results of suitable



COME OUT & RELATED TERMS

experiments. —EMERGENCE (*n.*) ***emergent*** (*adj.*) ↑ ISSUE

AF101 ooze (*v.i.*) (Of a viscous liquid) to flow slowly, *e.g.* blood oozes out of a small cut. ↓ EXUDE (Sn) ↑ ISSUE → PERCOLATE

AF102 exude (*v.t.,i.*) **1** (*v.i.*) To come out of a surface, slowly in small drops, *i.e.* as a fluid emerging from numerous, and almost invisible, small openings, *e.g.* ***a*** resin produced in some trees exudes over the bark; ***b*** sweat exudes from the skin. **2** (*v.t.*) To cause a liquid to exude, *e.g.* to exude resin. —***exudation, exudate*** (*n.*) ***exuded*** (*adj.*) ↑ ISSUE · OOZE (Sn)

AF103 give off (*v.t.*) (Of an object, organism or process) to cause to come from itself; to release, *e.g.* when steam rises from boiling water, the boiling water is said to give off steam. The term can be used for any gas or odour, which similarly comes from an object or chemical process, *e.g.* ***a*** animals recognise each other by the odour they give off; ***b*** when zinc is added to dilute sulphuric acid, hydrogen is given off. ↓ GIVE OUT · RELEASE · LIBERATE[2] → EVOLVE[3]

AF104 give out (*v.t.*) (Of an object, source or process) to cause energy to come from itself, *e.g.* when light comes from a lamp, the lamp is said to give out light. The term can be used for other forms of energy which similarly come from an object, or other source or process, *e.g.* ***a*** a fire gives out heat; ***b*** a candle gives out light; ***c*** a piece of uranium gives out radiation; ***d*** some chemical reactions give out heat. Note the difference between **give out** and **emit**: a candle gives out light, but hot particles of carbon in the flame emit light, *i.e.* emit needs a defined source; give out is a diffuse term. ↑ GIVE OFF → TAKE IN (An)

AF105 release (*v.t.*) To set free from a physical tie or restraint, *e.g.* when the tap of a gas cylinder is opened, the gas in it is released. —***release*** (*n.*) ↑ GIVE OFF

AF106 liberate[2] (*v.t.*) **1** To set free by the loosening of ties, bonds or constraints. The focus is on the loosening of the bonds, *e.g.* a capsule fruit, when ripe, splits and liberates the seeds. **2** To give off a gas by the breaking of chemical bonds, *e.g.* solid lead nitrate liberates nitrogen dioxide and oxygen on heating. Compare **give off**: lead (II) nitrate gives off nitrogen dioxide and oxygen on heating; this is a general observation without the implication that bonds have been broken. —***liberation*** (*n.*) ↑ GIVE OFF

AF107 discharge[1] (*v.t.,i.*) **1** (*v.t.*) To empty some or all of the contents from a containing vessel or structure, or from a biological structure or organ, *e.g.* ***a*** a boil discharges pus; ***b*** the contents of the bladder are discharged during urination; ***c*** earthing a charged capacitor discharges it. **2** (*v.i.*) To be discharged, *e.g.* liquid discharges from a vessel. —***discharge*** (*n.*) ↓ LEAK (Sn) · EXPEL (Sn) ↑ TRAVEL → RETAIN (An)

AF108 leak (*v.t.,i.*) **1** (*v.i.*) (Of gases, liquids and radiations) to escape through a small hole or crack in a containing vessel or barrier, *e.g.* ***a*** gas leaks out of a crack in a pipe; ***b*** radiation may leak through a defective screen. **2** (*v.i.*) (Of a vessel or structure) to allow to leak, *e.g.* a cracked beaker leaks. **3** (*v.t.*) To allow gas, liquid or radiation to leak, *e.g.* ***a*** cracked rubber tubing leaks water; ***b*** to leak a gas into a reaction vessel, *i.e.* to let gas in slowly through a small hole or tube. —***leak*** (*n.*) ***leaky, leaking*** (*adj.*) ↓ SPURT · EJACULATE · GUSH ↑ DISCHARGE[1] · → EFFUSE

AF109 spurt (*v.i.*) To throw out a stream or jet of liquid or gas through a cut, hole or opening. The pressure causing the spurting originates inside the containing structure and the process is sudden, *e.g.* ***a*** blood spurts from a cut artery (blood pressure within the body causes the spurting); ***b*** pressure of steam inside a steam-can may sometimes cause water to spurt out of the safety tube. —***spurt*** (*n.*)↑ LEAK → SQUIRT (Sn)

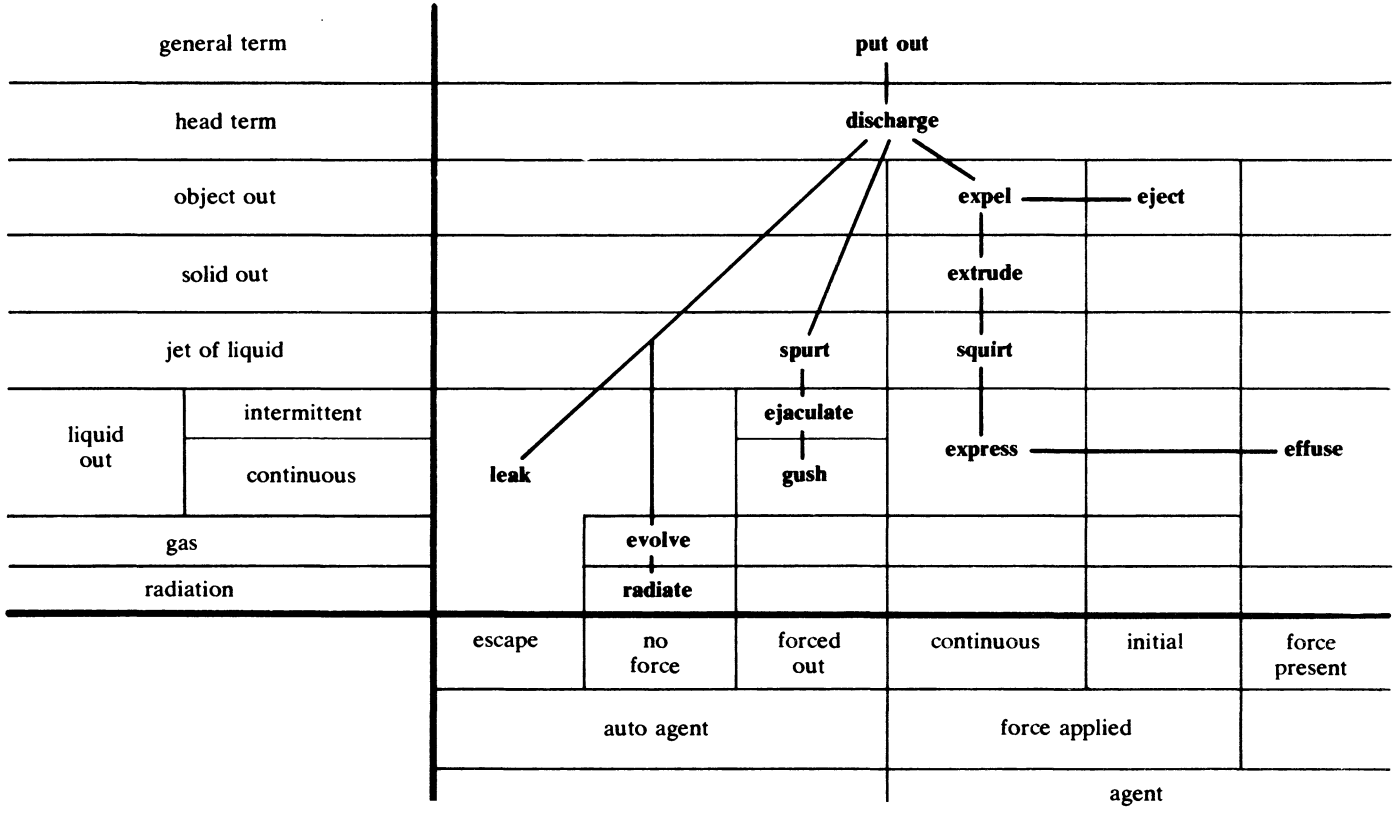
AF110 ejaculate (*v.t.*) To cause to spurt out with some force; it implies an interrupted stream of liquid, *e.g.* semen is ejaculated from a penis; compare sperms are **discharged** from a cloaca. ↑ LEAK · SPURT (Sn)

AF111 gush (*v.i.*) (Of liquids) to flow out in a copious stream from an opening. The term implies pressure behind the flow, and the pressure originates within the containing structure or vessel, *e.g.* oil gushes out of an oil-well (pressure originates in the underground supply of oil) □ *to gush out of; to gush from* ↑ LEAK

AF112 expel (*v.t.*) To drive out by applying a continuing force. The term implies a strong force, but does not imply considerable speed, *e.g.* ***a*** by compressing the chest, air is expelled from the lungs (the compression is continuous; the speed of the air is not great); ***b*** compressed air in the chamber of a force pump expels water on the upstroke of the pump (the speed of the water is not great); ***c*** an extractor fan expels air from a room (continuous action of the fan) □ *to expel from* —***expulsion*** (*n.*) ***expulsive, expelled*** (*adj.*) ↓ EJECT (Sn) · EXTRUDE · SQUIRT · EXPRESS · EFFUSE · FLUSH ↑ DISCHARGE[1]

AF113 eject (*v.t.*) To throw out by applying a sudden force. The term implies a strong force producing considerable speed, *e.g.* ***a*** the spores of a fern are ejected from the sporangium (they are thrown out with considerable force in order to scatter them); ***b*** in the decay of radium, an alpha-particle is ejected from the nucleus of the atom (considerable force is required to remove the alpha-particles) □ *to eject from* —***ejection, ejector*** (*n.*) ***ejective, ejected*** (*adj.*) ↑ EXPEL (Sn)

AF114 extrude (*v.t.*) To force a hot or soft solid through an orifice to form a shaped solid on hardening, *e.g.* ***a*** some metals can be extruded through an orifice to form a rod or a tube; ***b*** molten rock is extruded through an opening in the earth's crust □ *to extrude from; to extrude through* —***extrusion*** (*n.*)



DISCHARGE & RELATED TERMS

extrusive, extruded (*adj.*) ↑ EXPEL

AF115 squirt (*v.t.*) To eject a thin stream of liquid through a narrow orifice by pressure, *e.g.* ***a*** pushing the handle of a syringe squirts water through the nozzle; ***b*** an octopus squirts ink at its enemies (muscular contraction supplies the pressure). ↑ EXPEL · SPURT (Sn)

AF116 express (*v.t.*) To apply pressure in order to obtain a liquid extract, *e.g.* pressing olives to express olive oil. —***expression*** (*n.*) ↑ EXPEL

AF117 effuse (*v.i.*) (Of a gas) to pass through a small hole or a porous material, under pressure to escape. **Diffuse** implies a similar process, involving movement of the gas molecules, but the escape of gas is caused by molecular movement not pressure. ↑ EXPEL · LEAK (Sn) → DIFFUSE[1] (Sn)

AF118 flush (*v.t.*) To remove or clean by a rush of water, *e.g.* drains are flushed with water to remove dirt. ↑ EXPEL

AF119 extract[1] (*v.t.*) **1** To remove an object by pulling or by suction from within a containing structure, *e.g.* ***a*** a dentist extracts a tooth (by pulling it out); ***b*** a fan extracts air from a room. **2** To obtain by separating, *e.g.* to extract a metal from its ore. —EXTRACTION (*n.*) ↓ ERADICATE · ELIMINATE ↑ TRAVEL → REMOVE (Sn) · EXTRACT[2]

AF120 eradicate (*v.t.*) To remove forcibly and completely an object, idea, or concept, which has established itself and is undesirable, *e.g.* a campaign to eradicate malaria from a country (implies that a great deal of effort is necessary, that no trace of malaria remains and that malaria is an undesirable disease). —***eradication*** (*n.*) ***eradicable*** (*adj.*) ↓ ELIMINATE (Sn) ↑ EXTRACT[1]

AF121 eliminate (*v.t.*) To remove an object, substance, statement, or mathematical quantity, which is irrelevant, unsuccessful, unnecessary or undesirable. The term does not indicate how it is to be done, *i.e.* the focus is on the removal, and not on the method employed, *e.g.* ***a*** the badminton team was eliminated from the World Championship (it was unsuccessful); ***b*** toxins from pathogens are eliminated from the body (toxins are undesirable); ***c*** extinct species of animals have been eliminated (the species was unsuccessful); ***d*** a source of error is eliminated in order to improve results (error is undesirable) □ *to eliminate from* —***elimination*** (*n.*) ↓ EXCLUDE · EXCEPT ↑ EXTRACT[1]

AF122 exclude (*v.t.*) To put out, leave out, or keep out, *e.g.* in the preparation of anhydrous ferric chloride, a drying tube is attached to the exit from the receiver to exclude atmospheric moisture. —***exclusion*** (*n.*) ***exclusive*** (*adj.*) ↑ ELIMINATE → INCLUDE (I)

AF123 except (*v.t.*) Not to include in a discussion, consideration, or statement, *e.g.* ***a*** lithium carbonate is excepted from the rule that the carbonates of the alkali metals are not decomposed by heat (a statement in which a substance is not included); ***b*** the earth's magnetic field is usually excepted when discussing electromagnetic phenomena such as the principle of the generator (a discussion with a condition not included); ***c*** the duck-billed platypus is excepted from the rule that mammals are viviparous. —***exception*** (*n.*) ***except*** (*prep.*) ***except that, except for*** (*conj.*) ↑ ELIMINATE → INCLUDE (An)

AF124 insert (*v.t.*) To put a solid object in a fixed position between or amongst other objects, *e.g.* to insert an additional resistor in an electrical circuit □ *to insert a capacitor between two others; to insert an additional result amongst others* —INSERTION (*n.*) ↓ INTRODUCE (Sn) · INTERPOSE (Sn) ↑ TRAVEL

AF125 introduce (*v.t.*) To put a liquid or a solid into a receptacle or a vessel when some skill or a special technique is necessary, *e.g.* phosphorous pentoxide is a difficult substance to handle, it can be put in a beaker, but it has to be introduced into a distillation flask, using a paper funnel and glass rod □ *to introduce into* —***introduction*** (*n.*) ↓ TAKE IN ↑ INSERT (Sn)

AF126 take in (*v.t.*) (Of plants and animals) to cause substances to enter the organism through an action or biological process, *e.g.* ***a*** a man takes in food through his mouth; ***b*** a plant takes in mineral salts from the soil by diffusion. Although an organism usually takes in substances for nourishment, it may also take in harmful substances. The focus is on the activity of the organism. ↑ INTRODUCE → GIVE OUT (Cn)

AF127 interpose (*v.t.*) To put an obstruction, or solid object, between two other objects to protect one object from the other, or to hinder the action of one object on another, *e.g.* ***a*** to interpose a lead screen between a radioactive source and an observer; ***b*** to interpose a medium of high dielectric constant (relative permittivity) between two electric charges to reduce the force between the charges □ *to interpose between* —***interposition*** (*n.*) ↑ INSERT (Sn)

AF128 penetrate (*v.t.*) To go into or through a substance or a tissue because of a force being applied, or because of energy being used in the penetration. The focus is on the agent that penetrates, *e.g.* ***a*** γ-rays penetrate steel to a greater depth than X-rays; ***b*** hookworm larvae penetrate through the skin and tissues of a person's foot. —PENETRATION (*n.*) PENETRATED, PENETRABLE, PENETRATING (*adj.*) ***unpenetrated*** (*adj.*) ↓ PIERCE · PUNCTURE · RUPTURE · PERMEATE · PENETRATION · PENETRATING · PERMEABLE ↑ TRAVEL

AF129 pierce (*v.t.*) To go right through a surface or a material, usually by means of a sharp instrument, and with force applied to the instrument. The focus is on the surface or material, *e.g.* ***a*** the proboscis of a mosquito pierces the skin of a person when taking a blood meal; ***b*** hookworm larvae pierce the skin of a person's foot, *i.e.* the

focus is on the site of entry – the skin – but not on the hookworm having entered the person's foot. —***pierced*** (*adj.*) ↓ PUNCTURE (Sn) ↑ PENETRATE

AF130 puncture (*v.t.*) To make a small hole in a surface or a bounding membrane, *e.g.* a flea bites its host and punctures the skin. The focus is on the hole that has been made. —***puncture*** (*n.*) ***punctured*** (*adj.*) ↑ PENETRATE → MEMBRANE

AF131 rupture (*v.*) **1** (*v.t.*) To break by pulling or forcing apart. The result, a rupture, is a torn hole in a bounding surface, *e.g.* ***a*** the ear-drum can be ruptured by a sharp blow, either by an instrument or by high air pressure; ***b*** the skin over a boil is ruptured when the boil bursts; ***c*** if the force on a semipermeable membrane, caused by osmotic pressure, reaches a very high level, the membrane is ruptured. **2** (*v.i.*) To be broken in this way, *e.g.* an eardrum ruptures as a result of a sharp blow. —***rupture*** (*n.*) ↑ PENETRATE

AF132 permeate (*v.t.*) To pass all over or into a material or substance by particle diffusion. The term implies a lack of force, as does diffusion, but diffusion refers to the molecular state of the spreading substance. The permeating substance does not pass through the material. A stationary phase, such as sand, is usually permeated throughout by a fluid phase, such as water or air, *e.g.* rain water permeates the soil. —***permeation*** (*n.*) ***permeating*** (*adj.*) ***permeated*** (*adj.*) ↓ SEEP · IMPREGNATE · PERVADE (Sn) ↑ PENETRATE → DIFFUSION

AF133 seep (*v.i.*) (Of a fluid) to pass slowly through a porous material. The fluid can seep in all directions, including upwards, and follows a general course guided by gravity, pressure, or the nature of the material. The focus is on the slowness of the movement and on the fluid. Contrast **permeate** in which the fluid passes all over the material, *e.g.* ***a*** petroleum seeps up through sand from a natural deposit; ***b*** contaminated water escapes from a damaged sewer and seeps through the soil □ *to seep through* —SEEPAGE (*n.*) ↑ PERMEATE → PERCOLATE (Sn)

AF134 impregnate (*v.t.*) To cause to fill every part of a substance or structure. The focus is on an implied agent, *e.g.* ***a*** wooden poles are impregnated with tar to prevent them from rotting (a human agent has conducted the process); ***b*** the cell walls of older plant cells are impregnated with lignin (implied agent has caused the process and the whole of the cell-wall is impregnated with lignin) □ *to impregnate with* —***impregnation*** (*n.*) ***impregnated*** (*adj.*) ↑ PERMEATE

AF135 pervade (*v.t.*) To pass all over a space so that the concentration is uniform; the space is most commonly filled with air, *e.g.* ***a*** hydrogen sulphide gas pervades the air in a laboratory; ***b*** sound pervades a large room. ↑ PERMEATE

AF136 penetration (*n.*) **1** The action of penetrating. **2** The extent of penetrating, *e.g.* the maximum penetration of α-rays into steel is 15 cm. ↓ PERMEABILITY · SEEPAGE ↑ PENETRATE

AF137 permeability (*n.*) The disposition of a material to pass a fluid or a solute through itself. The fluid first of all permeates the material until the material is saturated, and the excess fluid then passes through the material, *e.g.* when equal quantities of water are poured onto equal quantities of sand and clay, water passes through the sand more quickly than through the clay; the permeability of sand is greater than that of clay. ↓ PERMEABLE ↑ PENETRATION

AF138 seepage (*n.*) **1** Small pools of liquid which are the result of seeping, *e.g.* small seepages of water exposed to sunlight are used by some anopheline mosquitoes for breeding. **2** The action of seeping. ↑ PENETRATION ↑ SEEP

AF139 penetrating (*adj.*) Describes an agent, especially radiation, with the power to penetrate, *e.g.* X-rays with short wavelengths are very penetrating (they can pass through solids). ↓ PENETRATED · PENETRABLE · IMPENETRABLE ↑ PENETRATE

AF140 penetrated (*adj.*) Describes a substance or tissue that has undergone penetration. ↑ PENETRATING

AF141 penetrable (*adj.*) Describes a substance or tissue that can be penetrated by a named agent □ *flesh is penetrable by X-rays, but bones are not* ↓ IMPENETRABLE ↑ PENETRATING

AF142 impenetrable (*adj.*) Describes a material, structure, or tissue that is not able to be penetrated, *e.g.* a sheet of paper is impenetrable to α-rays, *i.e.* the sheet of paper stops α-rays. ↑ PENETRATING · PENETRABLE (An)

AF143 permeable (*adj.*) Capable of allowing fluid substances to pass through, usually by a process of particle diffusion in materials, by molecular diffusion in artificial membranes, and by active or passive transport in biological membranes, *e.g.* ***a*** sand is more permeable to water than clay, *i.e.* it allows water to pass through more easily; ***b*** a permeable membrane allows water and solutes to pass through it □ *a membrane which is permeable to ethanol* —PERMEABILITY (*n.*) ↓ SEMIPERMEABLE · IMPERMEABLE (An) · IMPERVIOUS[1] · DIFFERENTIALLY PERMEABLE ↑ PENETRATE · PERMEABILITY → MEMBRANE

AF144 semipermeable (*adj.*) Describes a membrane which is permeable to solvents but not to solutes. A semipermeable membrane is used in osmosis. ↓ DIFFERENTIALLY PERMEABLE ↑ PERMEABLE

AF145 impermeable (*adj.*) Not allowing fluid substances to pass through, *e.g.* ***a*** an impermeable membrane does not allow solvents or solutes to pass through; ***b*** an impermeable rock does not allow water to pass through it □ *the rock is impermeable to water* ↑ PERMEABLE (An)

AF146 impervious[1] (*adj.*) Describes a

surface that does not allow fluids to pass through it, *e.g.* ***a*** the layer of cork round a tree trunk is impervious to water; ***b*** the cuticle of a leaf is impervious to water □ *waterproof cloth is impervious to rainwater* ↑ PERMEABLE

AF147 differentially permeable (*adj.*) Describes a membrane which is permeable to some substances and semipermeable to some solvents. Only membranes of living cells are differentially permeable. The permeability of a biological membrane can vary between wide limits, depending on cell activity, and can change from semipermeability to permeability. ↑ PERMEABLE

Change

AG001 increase[1] (*v.t.*) To cause to become greater in mass, length, area, volume, time, rate, number, amount or magnitude. The changes are caused by either a controlled change in conditions, or an addition to the material or energy present, *e.g.* ***a*** heating a metal rod (controlled change of condition) increases the length of the rod; ***b*** adding a second resistor in series to an electrical circuit increases the resistance in the circuit (addition causing an increase in magnitude) □ *to increase by* —INCREASE (*n.*) ***increased*** (*adj.*) ↓ ENLARGE · ELONGATE · MAGNIFY · DEVELOP[2] · INCREASE[2] · MAGNIFICATION[1] · EXTENDED · MAGNIFIED · DECREASE[1] (Cn) · VIBRATE → TRAVEL

AG002 enlarge (*v.t.*) To make larger; to increase the area or size of, *e.g.* ***a*** to enlarge a hole in a cork; ***b*** to enlarge a diagram; ***c*** to enlarge the aperture of a lens; ***d*** certain diseases enlarge the liver. —***enlargement*** (*n.*) ***enlarged*** (*adj.*) ↓ DILATE[1] · DISTEND · INFLATE ↑ INCREASE[1] → REDUCE (Cn)

AG003 dilate[1] (*v.t.*) To increase the diameter of a tube, pipe, aperture or orifice, *e.g.* ***a*** TNT dilates the arteries in the body; ***b*** eyedrops dilate the pupil of the eye. —***dilation*** (*n.*) ***dilatation*** (*n.*) ***dilated*** (*adj.*) ↑ ENLARGE → CONSTRICT (Cn)

AG004 distend (*v.t.,i.*) **1** (*v.t.*) To cause a receptacle to swell because of internal pressure from a gas, or from solid or liquid contents, *e.g.*, the intestines are distended by gaseous products of bacterial decomposition. *Distend* implies an increase in volume, or size, beyond the normal limits. **2** (*v.i.*) To swell of its own accord, *e.g.* the stomach distends when too much is eaten. —***distention*** (*n.*) ***distended*** (*adj.*) ↑ ENLARGE → SWELL

AG005 inflate (*v.t.*) To distend a receptacle with a gas by artificial means, *e.g.* ***a*** pumping air into a balloon inflates it; ***b*** air blown into the lungs inflates them. ***inflation*** (*n.*) ***inflated, inflatable*** (*adj.*) ↑ ENLARGE → DEFLATE (Cn)

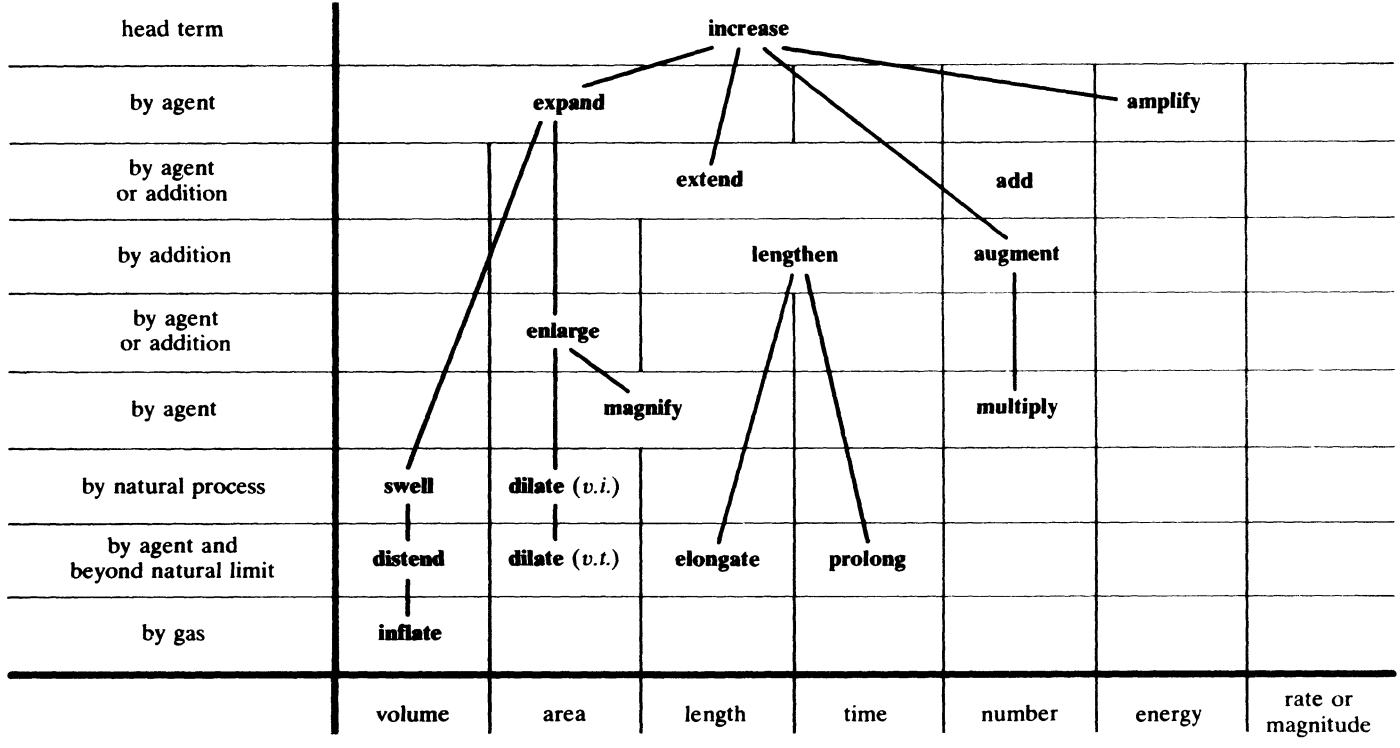
AG006 elongate (*v.t.,i.*) **1** (*v.t.*) To increase in length by applying a force, *e.g.* a rubber band is elongated by stretching. Note: a rubber band is **lengthened** by adding another piece of rubber band, but the rubber band is **elongated** by pulling the ends apart. **2** (*v.i.*) To become stretched, *e.g.* a spring elongates when a force is applied to one end. —***elongation*** (*n.*) ↓ LENGTHEN · PROLONG · EXTEND[1] · PRODUCE[2] · PRODUCE BACKWARDS ↑ INCREASE[1]

AG007 lengthen (*v.t.,i.*) **1** (*v.t.*) To increase the length of an object by addition. Note: an object is **lengthened** but its length is **increased**, *e.g.* a pendulum is lengthened when its length is increased by 5 cm. **2** (*v.t.*) To increase in time, *e.g.* to lengthen the period of a pendulum by lengthening the pendulum, *i.e.* to make the time of swing longer by making the pendulum longer. **3** (*v.i.*) To grow longer, *e.g.* the days lengthen as summer approaches (the days become longer and the nights shorter). ↑ ELONGATE → SHORTEN (Cn)

AG008 prolong (*v.t.*) To lengthen the time of a process, especially beyond what is useful or desirable. Contrast **lengthen** and **prolong**; ***a*** lengthening the time of distillation can be carried out by heating more slowly; ***b*** the time of distillation can be prolonged beyond the point at which useful distillation has ceased □ *to prolong beyond the point of usefulness* —***prolongation*** (*n.*) ***prolonged*** (*adj.*) ↑ ELONGATE

AG009 extend[1] (*v.t.*) To increase in area, length, range, time, or use; the increase can be by addition, or by application of a force, or by the use of an appropriate instrument, *e.g.* ***a*** the poles of a magnet are extended by adding two soft-iron pole pieces to concentrate the magnetic field; ***b*** a spring is extended by applying a force to one end; ***c*** the range of reading of a galvanometer is extended by the use of **shunts** and **multipliers**; ***d*** the period of observation must be extended until the reaction is complete —***extension*** (*n.*) ↑ ELONGATE → CURTAIL (Cn)

AG010 produce[2] (*v.t.*) To lengthen a line or a graph in the direction in which it was originally drawn, or in which a variable increases in magnitude, *e.g.* ***a*** to produce the line forming the base of a triangle to make one external angle of a triangle; ***b*** having plotted a straight line to relate pressure and thermodynamic temperature of a gas between 273 K and 373 K, to produce the line to a temperature of 400 K to determine the pressure at that temperature (the line is produced but the pressure for that temperature is extrapolated). ↑ ELONGATE · LENGTHEN (Sn) → EXTRAPOLATE



INCREASE & RELATED TERMS

AG011 produce backwards (*v.t.*) To lengthen a line or a graph in the opposite direction to which it was originally drawn, or in which a variable decreases in magnitude, *e.g.* ***a*** a line AB is drawn from A to B; if the line is lengthened from the point A, the line AB is produced backwards; ***b*** having plotted a straight line to relate pressure and thermodynamic temperature of a gas between 273 K and 373 K, to lengthen the graph to zero pressure to determine the absolute zero of temperature (the line is produced backwards but the temperature for that pressure is extrapolated). ↑ ELONGATE → EXTRAPOLATE

AG012 magnify (*v.t.*) To make, or be able to make, the size of an object appear larger when seen through an optical device, *e.g.* a microscope magnifies small objects □ *the object is magnified by the system of lenses* —MAGNIFICATION (*n.*) ***magnified*** (*adj.*) ↓ AMPLIFY · MULTIPLY · AUGMENT ↑ INCREASE[1] · ENLARGE → DIMINISH (Cn)

AG013 amplify (*v.t.*) To increase the magnitude of a form of energy, especially energy travelling in waves, *e.g.* ***a*** a speaking-trumpet or loud-hailer amplifies the sound of the human voice for those purposes when the voice would not be heard; ***b*** a triode valve is used to amplify voltage changes which otherwise would be too small. —***amplification*** (*n.*) ***amplified*** (*adj.*) ↑ MAGNIFY → ABATE (Cn)

AG014 multiply (*v.i.*) To increase in number by a natural process, *e.g.* sexual or asexual reproduction of animals (natural process) increases the number of offspring and the animals multiply. —***multiplication*** (*n.*) ↑ MAGNIFY → DWINDLE (Cn) · PROPAGATE

AG015 augment (*v.t.*) To increase in number or size by addition; the addition increases the effect of the objects present, *e.g.* a furnace is heated by a number of burners, but as the heating effect is insufficient for the particular purpose, several more burners are added and they augment the heating effect. —***augmentation*** (*n.*) ↑ MAGNIFY → DIMINISH (Cn)

AG016 develop[2] (*v.t.,i.*) **1** (*v.t.*) To cause to change through several stages, and to produce a complex structure or function from a simple structure or function, *e.g.* ***a*** engineers developed a jet engine from a simple rocket; ***b*** scientists develop new drugs from simpler chemical compounds; ***c*** Einstein developed a complex theory from simple ideas and observations. **2** (*v.i.*) To change in stages and become more complex or useful □ *to develop a laboratory process into an industrial process; to develop an industrial process from a laboratory process* —DEVELOPMENT (*n.*) ↓ EVOLVE[1] · EVOLVE[1] ↑ INCREASE[1] → DEVELOP[1] · ELABORATE[2] · REFINE · PERFECT[2]

AG017 evolve[3] (*v.t.,i.*) **1** (*v.i.*) To change continuously to form a new state where the state had not existed before, *e.g.* a plan of investigation evolved after the scientists had examined the preliminary results of their experiments (previously there had been no plan; a continuous change in their thoughts took place as the plan evolved). Contrast **develop**: if the scientists had had an initial simple plan, then they would have *developed* a more complex plan of investigation. **2** (*v.t.*) To produce by continuous change, *e.g.* Einstein evolved the theory of relativity. —EVOLUTION (*n.*) ↑ DEVELOP[2] (Sn)

AG018 evolve[4] (*v.i.*) (Of organisms) to change continuously and slowly to form new species, *e.g.* the modern horse evolved from *Eohippus*, an animal about 30 cm high with five toes, living in the Eocene age (the modern horse did not exist before it evolved; the process of change was slow and continuous) □ *modern birds have evolved from reptiles* —EVOLUTION (*n.*) ↑ DEVELOP[2]

AG019 increase[2] (*v.i.*) To become greater in mass, length, area, volume, time, rate number, amount or magnitude. The changes can be observed and are due to a change in conditions only, *e.g.* ***a*** an iron bar increases in length when it becomes hot (change in condition); ***b*** the speed (a rate) of a motor car increases when the amount of petrol supplied to the engine is increased □ *the length* increases by *5 mm; the force* increases from *10* N *to 15* N —INCREASE (*n.*) ↓ EXPAND · DILATE[2] · SWELL · ACCUMULATE ↑ INCREASE[1] → DECREASE[2] (Cn)

AG020 expand (*v.t.,i.*) **1** (*v.i.*) To become larger as a result of alterations in the external conditions; to increase in length, area, or volume, *e.g.* ***a*** a copper rod expands (becomes longer) when it is heated; ***b*** a gas expands (increases its volume) when the pressure on it is reduced; ***c*** a coiled spring expands (grows longer) when a force compressing it is removed. **2** (*v.t.*) To cause to expand, *e.g.* to expand a gas by heating it. —***expansion*** (*n.*) ***expanding, expanded*** (*adj.*) ↓ SWELL · ACCUMULATE ↑ INCREASE[1] → CONTRACT (Cn)

AG021 dilate[2] (*v.i.*) To increase in area or volume either by a natural process or because of a change in external conditions, *e.g.* ***a*** the pupil of the eye dilates when the iris muscles contract (a natural process); ***b*** a liquid dilates (increases in volume) when the temperature is raised (a change in external conditions) —***dilation, dilation*** (*n.*) ↑ INCREASE[1]

AG022 swell (*v.i.*) To become bigger because of internal pressure, *e.g.* the flesh round a dislocated joint swells (the size of the flesh round the joint increases beyond the normal size) □ *after a sting from an insect the flesh round the puncture swells up* —***swelling*** (*n.*) ***swollen*** (*adj.*) ↑ INCREASE[1] → SHRINK (Cn) · TUMESCENCE

AG023 accumulate (*v.t.,i.*) To collect together or to increase a quantity over a period of time, *e.g.* ***a*** a secondary cell accumulates electric charge by storing it as the products of electrolysis; the process takes several hours; ***b*** radiation from radioactive substances accumulates in the body and the absorption of small daily

quantities of radiation can add up to a total quantity harmful to the body. —***accumulator, accumulation*** (*n.*) ***cumulative*** (*adj.*) ↑ INCREASE[1]

AG024 magnification[1] (*n.*) **1** The act or process of magnifying or the amount by which an object is magnified. **2** A measure of the ability of an optical instrument to magnify objects; the magnifying power or the lateral magnification. —MAGNIFIED (*adj.*) ↓ EXPANSION ↑ INCREASE[1]

AG025 expansion (*n.*) **1** The act or process of making a length, area or volume, greater, *e.g.* the expansion in length is accompanied by a contraction in width. **2** The difference in length, area or volume, before and after these quantities have increased because the material has expanded. ↑ MAGNIFICATION[1]

AG026 extended (*adj.*) Stretched out or increased in length, especially to the fullest limit, *e.g.* an extended arm reaches out as far as possible. Contrast **stretched** or **stretched out**, which indicate extension, but not to the fullest extent. ↓ EXTENSIBLE · EXTENDIBLE · EXTENSILE · ↑ INCREASE[1] → EXTEND · EXTENSOR · EXTENSIVE

AG027 extensible (*adj.*) Capable of being extended, *e.g.* a rubber band or a metal spring, is extensible, as a force pulling at the end can extend the rubber band or spring. A piece of stone is not extensible. ↑ EXTENDED

AG028 extendible (*adj.*) An alternative term for EXTENSIBLE (↑).

AG029 extensile (*adj.*) Capable of stretching out, protruding or giving a greater range, *e.g.* ***a*** the anterior part of an earthworm is extensile and it extends itself in locomotion (the anterior part becomes longer by it stretching itself); ***b*** an arm is extensile as it extends itself by muscular effort when straightening out. ↑ EXTENDED

AG030 magnified (*adj.*) Made larger or greater, or made to appear larger, *e.g.* a magnified image seen through a lens. Note the difference between **magnified** and **enlarged:** ***a*** a micro-organism seen through a microscope appears magnified, a magnified image of the object is seen; ***b*** a micro-organism projected on a screen by a micro-projector forms an enlarged picture; the image is real, not seen through the optical device, so is an enlarged picture of the object ↑ INCREASE[1] → DIMINISHED

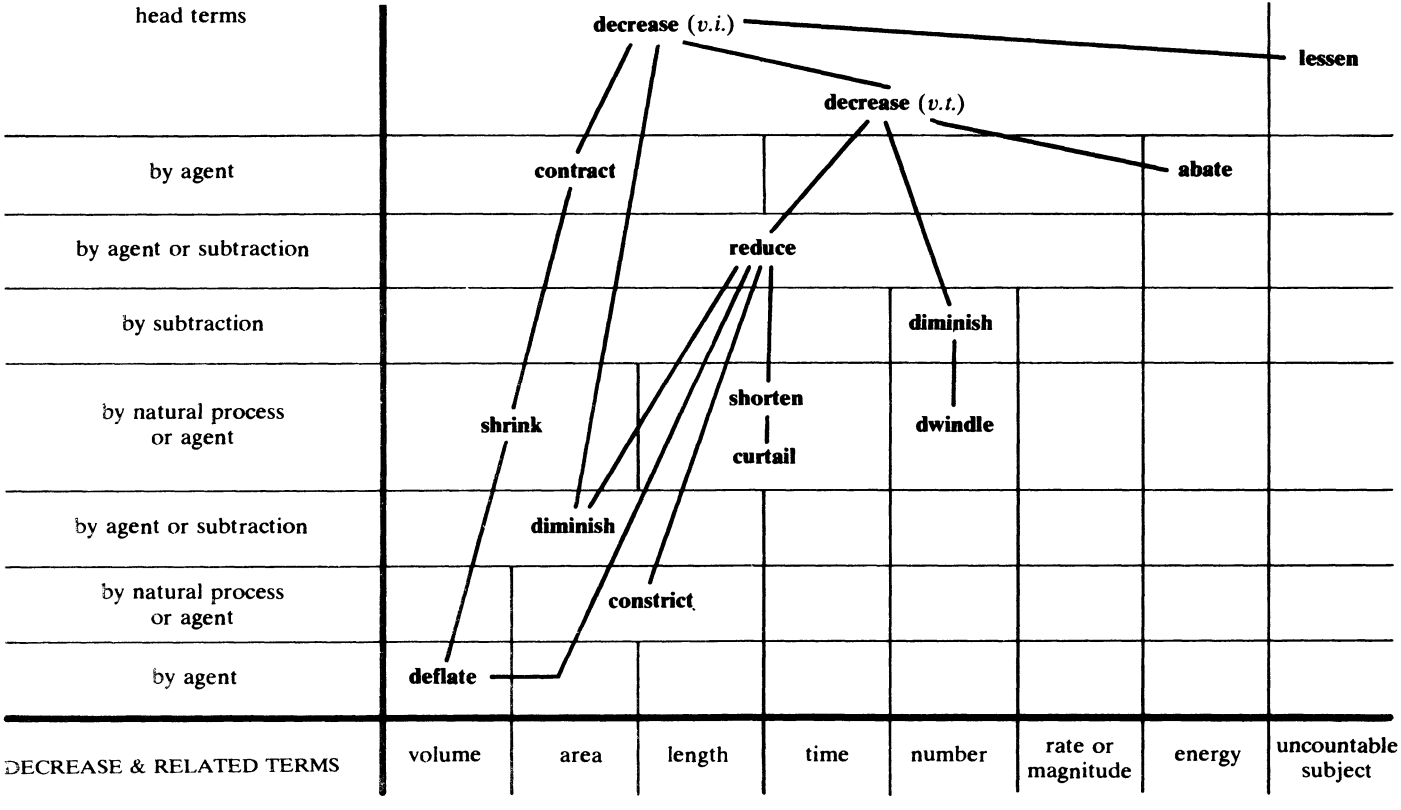
AG031 decrease[1] (*v.t.*) To cause to become smaller in mass, length, area, volume, time, rate, number, amount or magnitude. The changes are caused by either a controlled change in conditions, or a subtraction from the material, or energy, present, *e.g.* ***a*** cooling a metal rod (controlled change of condition) decreases the length of the rod, ***b*** removing a resistor in series from an electrical circuit decreases the resistance in the circuit (subtraction causing a decrease in magnitude). **Decrease** implies a continuous process. Note. *decrease* is used in a similar way to **increase**, *e.g.* to decrease the diameter of a pipe, or to decrease the pipe in diameter □ *the length of the rod is decreased by 5 mm by cooling; lowering the temperature by 80°C decreases the volume of the liquid by 5 cm*^{3} —DECREASE (*n.*) ***decreased*** (*adj.*) ↓ LESSEN · SHORTEN · DEFLATE · DECREASE[2] · CONTRACTABLE ↑ INCREASE[1] (Cn)

AG032 lessen (*v.t.,i.*) **1** (*v.t.*) To make less. Compare lessen with **reduce** and **decrease**. Lessen is used when it means 'make smaller in number', *e.g.* ***a*** to lessen the number of breakages in the laboratory (make the number less); ***b*** lowering the pressure on a gas lessens the probability of molecules colliding (makes the probability – a number – less). Lessen can not be used with physical quantities; one can *not* say 'lessen the pressure' or 'lessen the temperature' – here **lower** should be used. Lessen can be used of uncountable effects or processes, *e.g.* ***a*** a fever lessens when the temperature decreases; ***b*** the effect of a magnetic field is lessened by shielding the apparatus. **2** (*v.i.*) To become less. ↓ REDUCE · DIMINISH[1] ↑ DECREASE[1]

AG033 reduce (*v.t.*) To make smaller a mass, length, area, volume, number, amount or magnitude, or to decrease a time or rate. The term implies going from one specific state, level, or measurement, to another, *e.g.* to reduce the temperature from 40°C to 30°C. The process implied is discontinuous and the term may also imply making smaller a quantity which has previously been made greater, or returning a quantity to its normal value, *e.g.* when a flask containing air under pressure is uncorked, the pressure of the air in the flask is reduced to atmospheric pressure. The changes which cause something to be reduced are caused either by a controlled change in conditions or by subtraction, *e.g.* ***a*** reduce the length of the pendulum by intervals of 5 cm; ***b*** increasing the magnifying power of a microscope reduces the area of the field of view; ***c*** increasing the pressure of a gas reduces its volume; ***d*** carnivores reduce the number of herbivores, ***e*** lowering the temperature below the optimum value reduces the amount of ammonia formed from nitrogen and hydrogen in the equilibrium mixture; ***f*** the use of a catalyst often reduces the time needed for a chemical reaction □ *the length is* reduced by *5 cm, the length is* reduced to *3 m* —REDUCTION (*n.*) ***reducing, reduced*** (*adj.*) ↑ LESSEN · INCREASE[1] (Cn) · ENLARGE (Cn) · EXTEND (Cn)

AG034 diminish[1] (*v.t.*) To decrease in number by subtraction or to make the size of an object appear smaller, *e.g.* ***a*** a furnace is heated by a number of burners, but as the heating effect is too great, several burners are removed, and the heating effect is diminished (the final result leaves a complete unit); ***b*** an image which is diminished in size is still a complete unit. —***diminution*** (*n.*) DIMINISHED (*adj.*) ↑ LESSEN · AUGMENT (Cn) · MAGNIFY (Cn)

AG035 shorten (*v.t.*) To decrease some-


head terms
decrease (v.i.)
lessen
decrease (v.t.)
by agent
contract
abate
by agent or subtraction
reduce
by subtraction
diminish
by natural process or agent
shrink
shorten
curtail
dwindle
by agent or subtraction
diminish
by natural process or agent
constrict
by agent
deflate
DECREASE & RELATED TERMS
volume
area
length
time
number
rate or magnitude
energy
uncountable subject

thing in length or time, especially to reduce by cutting off. Note: an object is shortened when its length is **reduced.** ↓ CURTAIL · CONSTRICT ↑ DECREASE[1] · LENGTHEN (Cn)

AG036 curtail (*v.t.*) To shorten something in length or time, but the term also implies that the cutting off impairs the result, *e.g.* when an experiment is curtailed, it is completed by taking fewer readings than were originally planned; the experiment is finished in less time, but the results will not be as good as planned. Compare **shorten** and **curtail:** *Shortening* the time of distillation can be carried out by increasing the quantity of heat supplied (the full amount of distillate is collected in less time); *curtailing* the time of distillation is done by stopping the distillation before all the distillate has been collected (less time, but the result is impaired). —***curtailment*** (*n.*) ***curtailed*** (*adj.*) ↑ SHORTEN → PROLONG (Cn)

AG037 constrict (*v.t.*) To decrease the diameter of a tube, pipe, aperture or orifice, *e.g.* when the external temperature falls the blood capillaries under the skin are constricted. —CONSTRICTION (*n.*) ***constricted*** (*adj.*) ↑ SHORTEN → DILATE (Cn)

AG038 deflate (*v.t.,i.*) **1** (*v.t.*) To reduce the size of a receptacle by artificial means by removing gas, *e.g.* ***a*** allowing air to escape from a balloon deflates the balloon; ***b*** the lungs are deflated when air is forced out from them. **2** (*v.i.*) To become smaller because of loss of gas, *e.g.* a leaking tyre will slowly deflate. —***deflation*** (*n.*) ***deflatable, deflated*** (*adj.*) ↓ ABATE · CONTRACT · SHRINK ↑ DECREASE[1] → INFLATE (Cn)

AG039 abate (*v.t.,i.*) **1** (*v.t.*) To decrease the magnitude of a force or of energy because the existing magnitude is too great or excessive; the force or energy is reduced to a reasonable level, or desired magnitude. **2** (*v.i.*) To decrease from an excessive level, *e.g.* a storm abates. —***abatement*** (*n.*) ***abating, abated*** (*adj.*) ↑ DEFLATE → AMPLIFY (Cn)

AG040 decrease[2] (*v.i.*) To become smaller in mass, length, area, volume, time, rate, number, amount or magnitude. The changes can be observed and are due to a change in conditions only, *e.g.* ***a*** an iron bar decreases in length when it cools; ***b*** the rate of a chemical reaction decreases when the temperature falls; ***c*** the time to deposit a mole of copper atoms decreases as the electric current increases □ *the length decreases by 5 mm; the force decreases from 15* N *to 10* N —DECREASE (*n.*) ↓ DIMINISH[2] · CONTRACT · SHRINK · DWINDLE · FADE ↑ DECREASE[1] · INCREASE[2] (Cn)

AG041 diminish[2] (*v.i.*) To grow less, *i.e.* to undergo a continuous process of decreasing, *e.g.* during evaporation the volume of liquid diminishes. Note the difference between **diminish, reduce**, and **decrease**, all of which can be used with the same variables, *e.g.* a leak in a balloon leads to a diminishing pressure; if a *definite* volume of air is let out of the balloon, the pressure is *reduced*. If air is let out of the balloon (the manner and amount not specified) the pressure *decreases.* —***diminution*** (*n.*) ***diminishing*** (*adj.*) ↑ DECREASE[2]

AG042 contract (*v.i.*) To become smaller as a result of alterations in the external conditions; to decrease in length, area, or volume, *e.g.* ***a*** a copper rod contracts (becomes shorter) when it is cooled; ***b*** a gas contracts (decreases its volume) as its temperature falls. —***contraction*** (*n.*) ***contracting, contracted*** (*adj.*) ↑ DECREASE[2] → EXPAND (Cn)

AG043 shrink (*v.t.,i.*) **(shrank, shrunk) 1** (*v.i.*) To decrease by a natural process, *e.g.* ***a*** the skin of a fruit shrinks when it dries, producing splits in the skin (the normal size of the skin is that needed to cover the fruit; the skin becomes smaller when dry); ***b*** washing too often may make clothes shrink (no longer their correct or normal size). **2** (*v.t.*) To cause an object by an alteration in conditions to decrease in area, volume or size beyond its normal limit. —***shrinkage*** (*n.*) ***shrunken*** (*adj.*) ↑ DECREASE[2] → SWELL (Cn) · STRETCH (Cn)

AG044 dwindle (*v.i.*) To decrease steadily in number, area or volume until the quantity approaches zero, *e.g.* the number of tigers in the world is dwindling rapidly and the animals may one day become extinct. —***dwindling*** (*n.*) ***dwindling*** (*adj.*) ↑ DECREASE[2] → MULTIPLY (Cn)

AG045 fade (*v.t.,i.*) **1** (*v.i.*) To become reduced in intensity, *e.g.* ***a*** a radio signal fades; ***b*** a colour fades; ***c*** light from an electric light bulb fades as the voltage is lowered. **2** (*v.t.*) To cause to fade, *e.g.* sunlight can fade colours. ↑ DECREASE[2] → INTENSITY

AG046 contractable (*adj.*) Able to be made less in length, area or volume by an agent, *e.g.* ***a*** a metal rod is contractable, as cooling the rod makes it contract; ***b*** a liquid is contractable, as cooling the liquid reduces its volume. ↓ CONTRACTILE · SHRINKABLE · DIMINISHED ↑ DECREASE[2]

AG047 contractile (*adj.*) Having the ability to become contracted, *e.g.* ***a*** muscle cells have the ability to contract themselves when stimulated by a nerve; such cells are contractile; ***b*** the endodermal cells of a coelenterate are contractile; when stimulated their contraction shortens the organism. ↑ CONTRACTABLE

AG048 shrinkable (*adj.*) Describes a solid material that can have its area, volume, or size, decreased either by a suitable agent, or under certain conditions; the process of shrinking has not yet taken place. Contrast **shrunken** which describes the material when the process of shrinking has been completed, and **shrinking** when the process is taking place, *e.g.* ***a*** newly manufactured cotton cloth is shrinkable; when placed in water it shrinks; ***b*** a shrunken piece of cloth will not shrink further; ***c*** a shrinking cotton thread exerts a tension. Note the difference between **shrinkable** and **contractable**: if a material is contractable, it can also be expandable when conditions change, *i.e.* the

reverse process can take place; if a material is shrinkable, the process cannot be reversed, the material can only shrink, or stay as it is. ↑ CONTRACTABLE

AG049 diminished (*adj.*) Made smaller or less, or made to appear smaller, *e.g.* ***a*** a diminished signal from an inefficient electronic circuit; ***b*** a diminished image seen through a lens. Note the difference between **diminished** and **reduced**: ***a*** an image seen through a concave lens appears diminished; a diminished image of the object is seen through the lens; ***b*** a real image of the sun formed on a screen by a convex lens is a reduced image; the image is not seen through the lens so it is an image of the object which is reduced in size. ↑ CONTRACTABLE → MAGNIFIED

AG050 vibrate (*v.t.,i.*) **1** (*v.i.*) (Of an elastic medium) to move in a characteristic regular way, or to change shape, about an average position. The simplest example is a beam clamped at one end with the other end moving up and down quickly. A gas or liquid can also vibrate because of elasticity; sound waves are vibrations moving through a fluid as the molecules move backwards and forwards. **2** (*v.t.*) To cause to vibrate, *e.g.* to vibrate a diaphragm by applying an oscillating electric field □ *a tuning fork vibrates at a fixed frequency* —***vibration, vibrator, vibrancy*** (*n.*) ***vibrant,*** VIBRATING, VIBRATILE, ***vibrational, vibratory*** (*adj.*) ↓ OSCILLATE (Sn) · UNDULATE · FLUTTER[1] · SEE-SAW · PULSE[1] · UNDULATORY[1] · PULSATING ↑ INCREASE[1]

AG051 oscillate (*v.t.,i.*) **1** (*v.i.*) (Of a body) to move backwards and forwards, or up and down in a regular way, about an average position, *e.g.* ***a*** a pendulum oscillates about a mean position; ***b*** in a solid molecules oscillate about mean positions. **2** (*v.i.*) (Of quantities or values) to increase and decrease regularly, *e.g.* ***a*** in electromagnetic waves electric and magnetic fields oscillate (increase and decrease regularly); ***b*** an oscillating electric current repeatedly increases and decreases. **3** (*v.i.*) (Of an electrical circuit) to produce an oscillating current or voltage. **4** (*v.t.*) To cause to oscillate. **Vibrate** is used when the body is elastic and the elasticity of the material is the force restoring the original position or shape. **Oscillate (2, 3)** is used to describe increasing and decreasing values *i.e.* 'the electric current oscillates' is correct but 'the electric current vibrates' is not. Note also that oscillate (**2**) is similar in meaning to **alternate** when applied to an electric signal. Alternate, however, is used when the signal changes direction, whereas oscillate can be used for changing direction and also for the current going up and down in value without decreasing to zero □ *the circuit oscillates at a high frequency* or *oscillates with a high frequency* —***oscillation,*** OSCILLATOR (*n.*) OSCILLATORY, OSCILLATING ↓ SWEEP[2] · SCAN ↑ VIBRATE (Sn) → FLUCTUATE

AG052 sweep[2] (*v.t.,i.*) **1** (*v.t.*) To move continuously round a circle, or to and fro between the limits of an arc of a circle, so as to pass over all points of the circle or arc, *e.g.* a radar beam from a rotating aerial sweeps through a circle and so scans each point over which it passes. **2** (*v.t.*) To cause to move in this way, *e.g.* to sweep a radar beam □ *the light sweeps through a small arc* —***sweep*** (*n.*) ***sweeping*** (*adj.*) ↑ OSCILLATE

AG053 scan (*v.t.*) To sweep from side to side, observing or affecting each part of the track, *e.g.* ***a*** to sweep a television camera from side to side in successively lower sweeps to cover the surface of an object and so build up a picture from a series of picture elements, each originating from a point on the object; ***b*** in nuclear magnetic resonance, an additional weak magnetic field is applied with varying frequencies in a given range; the range is scanned to determine the frequencies at which resonance occurs. —***scan*** (*n.*) ↑ OSCILLATE

AG054 undulate (*v.i.*) **1** (Of a surface) to have the appearance of waves. **2** To move in smooth fairly long waves, *e.g.* a string undulates when fixed at one end and shaken at the other. —***undulation*** (*n.*) UNDULATORY (*adj.*) ↓ PULSATE · THROB ↑ VIBRATE

AG055 pulsate (*v.i.*) To emit or to possess any form of pulses in a regular rhythm; to expand and contract in a regular rhythm; to move backwards and forwards in a regular rhythm, *e.g.* ***a*** a pulsar (type of star) pulsates (emits short bursts of radiation at regular intervals of time); ***b*** the human heart pulsates. —PULSATION (*n.*) PULSATORY, PULSATING, PULSATIVE, PULSATILE (*adj.*) ↑ UNDULATE

AG056 throb (*v.i.*) **1** To pulsate, especially with a loud sound of low frequency, *e.g.* heavy machinery can throb when in operation. **2** (Of the heart) to beat more strongly than usual, giving an increased flow of blood. —***throb*** (*n.*) ↑ UNDULATE

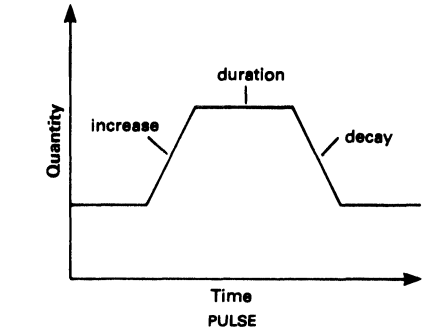
AG057 flutter[1] (*v.t.,i.*) **1** (*v.i.*) To vibrate in a quick, irregular manner; the term implies small, weak movements, *e.g.* ***a*** a bird's wings flutter when it is bathing; ***b*** when a person's pulse flutters it is weak with an irregular beat. **2** (*v.t.*) To cause to flutter, *e.g.* the bird fluttered its wings. —***flutter*** (*n.*) ↓ FLICKER ↑ VIBRATE

AG058 flicker (*v.i.*) To vary repeatedly in intensity, as of light from bright to dim and back to bright, *e.g.* a candle flame flickers when a sudden flow of air blows over it ↑ FLUTTER[1]

AG059 see-saw (*n.*) A plank supported at the middle with a person sitting on each end so that one person goes up as the other person goes down. The term is used to indicate a reciprocal effect between two objects, processes, forces, or conditions, *e.g.* the see-saw of curiosity and fear exhibited by an animal towards an unknown object. ↓ ZIG-ZAG ↑ VIBRATE

AG060 zig-zag (*n.*) A line or track that alternates from side to side about its direction of movement with the changes of direc-

tion forming acute angles; neither the angles nor the lines between them usually have any regularity, *e.g.* the track of a sailing ship sailing into the wind. ↑ SEE-SAW



PULSE

AG061 pulse[1] (*n.*) A brief increase in a quantity which is normally constant; its essential characteristics are an increase, a finite duration, and a decay. ↓ PULSATION ↑ VIBRATE

AG062 pulsation (*n.*) The process of producing pulses. ↑ PULSE[1]

AG063 undulatory[1] (*adj.*) Describes any motion which has the appearance of a wave motion, *e.g.* the undulatory movement of cilia or of the feet of a caterpillar. ↑ VIBRATE

AG064 pulsating[1] (*adj.*) Describes any quantity, or structure, which pulsates with a regular rhythm or periodicity, *e.g.* ***a*** a pulsating electric current is unidirectional and has periodic increases in magnitude; its value never falls to zero; ***b*** a pulsating vacuole expands and contracts with a regular rhythm; the vacuole never contracts sufficiently to disappear. ↓ PULSATORY · PULSATIVE · PULSATILE ↑ VIBRATE

AG065 pulsatory (*adj.*) Describes any process, or structure, associated with pulsation, *e.g.* the pulsatory nature of the flow of blood in the arteries. ↑ PULSATING[1]

AG066 pulsative (*adj.*) Describes an agent causing pulsation, *e.g.* a pulsative electric circuit producing a pulsating current. ↑ PULSATING[1]

AG067 pulsatile (*adj.*) Describes any autoagent producing a pulsatory process, *e.g.* the heart is a pulsatile organ as it produces by itself a pulsating flow of blood. ↑ PULSATING[1]

AG068 cut (*v.t.*) To use a sharp instrument, *e.g.* a knife, scissors or scalpel, or a tool, such as an axe, spade or shears, for one of the following purposes:

To cut into: to make an opening in the surface of solid material; the opening is either shallow or deep. Similar terms: **slit, incise, slash.**

To cut through: to divide solid material into two parts. Similar terms: **sever, split, cleave.**

To cut off: to remove a portion of a whole. Similar terms: **hack, slice, shear, clip, shave, crop, prune, lop, amputate.**

To cut up: to divide solid material into many small pieces. Similar terms: **mince, shred.**

To cut open: to make an opening in the surface to examine the inside. Similar term: **dissect.**

To cut out: to remove a part which is near the surface. Similar term: **excise.**

To cut to shape: to make a particular shape from a piece of solid material. Similar terms: **hew, trim, carve.** —***cutting, cut*** (*n.*) ***cut*** (*adj.*) ↓ SLIT[1] · DISSECT · SLICE · DIVIDE · SPREAD[2] · BREAK ↑ TRAVEL

AG069 slit[1] (*v.t.*) To make a long, straight, narrow cut in a surface; to cut into strips; to tear lengthwise, *e.g.* to slit open the wall of a frog's abdomen. Note: to **slash** implies a quick, inaccurate cut □ *to* slit open *the skin of a rabbit* —SLIT (*n.*) ***slitlike*** (*adj.*) ↓ INCISE (Sn) · CLEAVE ↑ CUT

AG070 incise (*v.t.*) To make an accurate, narrow, cut in a surface; it may be straight or curved, long or short; it is made as part of a surgical operation, or for biological purposes. —***incision*** (*n.*) INCISED (*adj.*) ↑ SLIT[1] (Sn)

AG071 cleave (*v.t.,i.*) **1** (*v.t.*) To make a clean and accurate cut through a solid, using a heavy blow, *e.g.* to cleave a crystal in two pieces along a plane of the crystal (the cut must be in the correct plane, and force must be used to make the cut). **2** (*v.i.*) To become cleaved, *e.g.* a diamond cleaves along certain crystal planes □ *to* cleave along *a line of a solid* —CLEAVAGE (*n.*) CLEFT, CLOVEN (*adj.*) ↑ SLIT[1] → SPLIT (Sn)

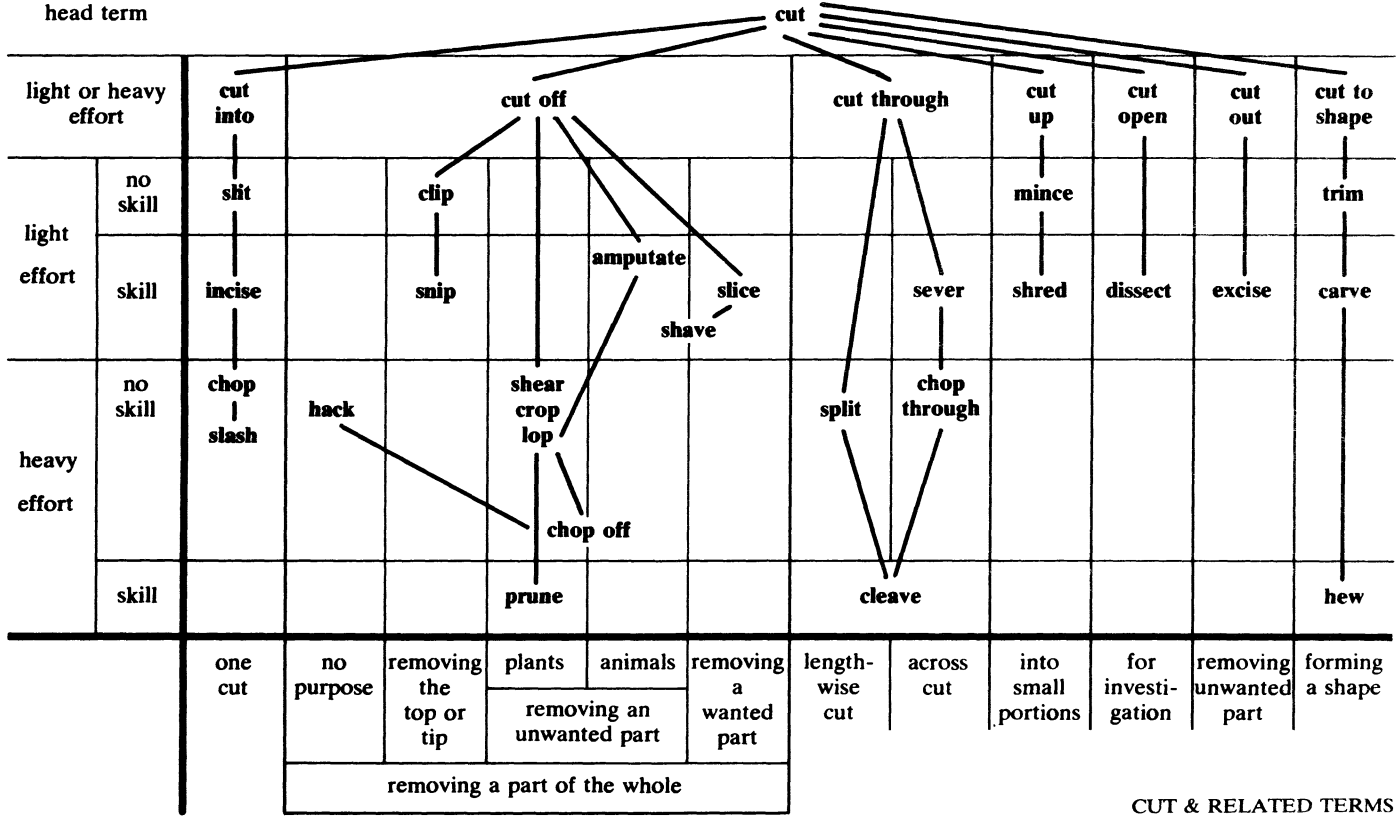
AG072 dissect (*v.t.*) To cut open an organism in order to display or show the parts or anatomy of it. Both skill and training are required for dissecting □ *the man* dissects out *the liver from a rabbit; he dissects a frog to examine its circulatory system* —***dissection*** (*n.*) ***dissected*** (*adj.*) ↓ PRUNE · LOP ↑ CUT

AG073 prune (*v.t.*) To cut off branches and to remove twigs from a tree or bush in order to encourage the correct growth of the tree or bush or to improve its shape, *e.g.* to prune an apple tree so that it produces more fruit. ↑ DISSECT

AG074 lop (*v.t.*) **(lopped) 1** To cut a branch off a tree. **2** To cut off a part, especially with a single heavy blow, as with an axe □ *to* lop *a branch* off *a tree; to* lop off *a branch* ↓ AMPUTATE ↑ DISSECT

AG075 slice (*v.t.*) To cut thin flat pieces from a larger piece of a solid, *e.g.* to cut thin flat pieces off the end of a plant stem □ *to slice off a piece from a stem; he slices a stem into small pieces* —***slice*** (*n.*) ***slicing, sliced*** (*adj.*) ↓ SHAVE · EXCISE · AMPUTATE · SEVER ↑ CUT

AG076 shave (*v.t.*) **1** To remove a small, very thin slice from a solid by scraping along the surface, *e.g.* ***a*** a carpenter's plane shaves wood; ***b*** a razor shaves hair from skin. Note the difference between **slice** and **shave.** Slice means to cut across the solid; shave means to cut along the surface □ *the man shaves off a beard; the man is shaving; the barber shaves the man.* **2** To come very



Change

AG076

CUT & RELATED TERMS

close to a surface while in motion without actually touching the surface —***shaving, shave*** (*n.*) ***shaved*** (*adj.*) ↑ SLICE (Sn)

AG077 excise (*v.t.*) To cut away by surgery and to remove an unwanted piece from a whole; the surrounding material is incised and the piece removed, *e.g.* to excise a cyst from a muscle. —***excision*** (*n.*) ***excised*** (*adj.*) ↑ SLICE

AG078 amputate (*v.t.*) To remove a limb or appendage of an animal by a surgical operation. —***amputation*** (*n.*) ***amputated*** (*adj.*) ↑ SLICE

AG079 sever (*v.t.*) To cut through an object, *e.g.* ***a*** to sever an artery while dissecting an animal (by accident); ***b*** to sever a piece of thread (on purpose). —***severance*** (*n.*) ***severed*** (*adj.*) ↑ SLICE

AG080 divide (*v.t.,i.*) **1** (*v.t.*) To cut, break, or otherwise make a whole into several different quantities or categories. The quantities so formed are fractions of the whole; the categories so formed are sections of the whole. When a whole is divided, portions are formed, *e.g.* ***a*** a filtrate is divided into three portions; ***b*** the elements are divided into the categories of metals and non-metals. **2** (*v.i.*) To become or be able to be divided, *e.g.* the elements divide into metals and non-metals. To distinguish **divide** and **separate**: an apple can be divided into two or more portions, each portion is a fraction of the apple; its parts consist of skin, flesh, core, pips and stalk, and these parts can be *separated* from each other. Separate is more likely to be used when different items are taken away and kept apart, *e.g.* to separate oil from water. Divide is more usual for cutting or breaking up a whole into portions, *e.g.* to divide a litre of water into ten equal parts. —***division*** (*n.*) ↓ SEPARATE[1] (Sn) · SHARE ↑ CUT

AG081 separate[1] (*v.t.*) To take a part away from a whole. The part removed must have some unity or be an entity, *e.g.* ***a*** to separate sheep from goats (the whole is a herd, sheep have a unity, they form a group of recognizable similar, animals, and so the sheep can be separated); ***b*** petrol can be separated from water using a separating funnel (the petrol and the water are immiscible and so have separate entities) □ *oil is separated from water* —***separation*** (*n.*) SEPARATE, SEPARATED, SEPARABLE (*adj.*) ↓ DISPERSE · SCATTER · DISSIPATE ↑ DIVIDE (Sn)

AG082 disperse (*v.t.*) To separate the parts or individual units of a whole from one another and to spread them. The focus is on the agent of dispersion, not on the parts, or units, dispersed, *e.g.* ***a*** light is dispersed by a prism (white light is separated into the colours of the spectrum, and the action of the prism is under consideration); ***b*** seeds are dispersed by various agents, *e.g.* wind, water, animals, etc.; ***c*** small droplets of an immiscible liquid can be dispersed in water to form a colloid. —DISPERSAL, DISPERSION (*n.*) DISPERSED (*adj.*) ↓ SCATTER (Sn) ↑ SEPARATE[1]

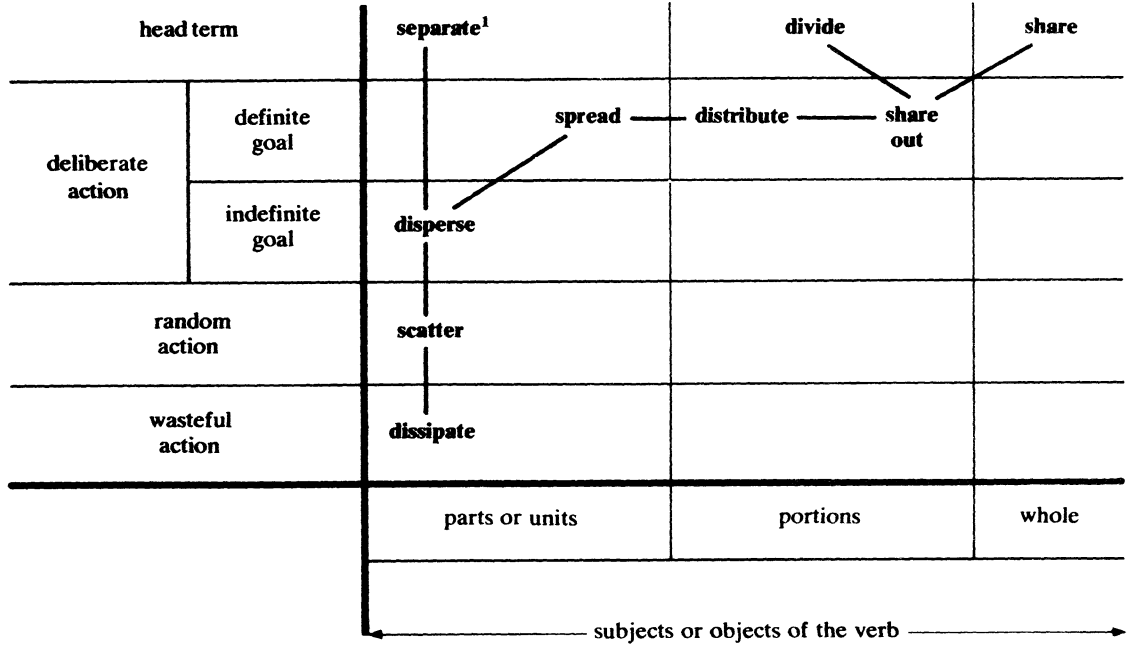
AG083 scatter (*v.t.*) To disperse the parts or individual units of a whole in a random manner; the term may imply the use of force, or of an obstruction scattering the parts or units of a moving whole; the focus is on the process, *e.g.* ***a*** a seed capsule breaks and scatters the seeds on the ground; ***b*** air molecules in the sky scatter light with frequencies corresponding to the blue region of the visible spectrum, giving the sky its blue colour. (The molecules are an obstruction to light waves in the blue region of the spectrum and they cause random scattering.) —***scatter*** (*n.*) ***scattered*** (*adj.*) ↑ SEPARATE[1]

AG084 dissipate (*v.t.*) To disperse' until objects or substances are no longer observable or energy is no longer effective, *e.g.* ***a*** the sun dissipates mist (the mist vanishes and is no longer visible); ***b*** vapour is dissipated in evaporation (the vapour vanishes into the atmosphere); ***c*** electrical energy is dissipated in the form of heat from a transformer (electrical energy is lost, and so wasted); ***d*** some of the energy of rocket propulsion is dissipated as light, seen in the flame of the exhaust (this energy is not available as useful work, and so is wasted). Note that the term often implies waste or loss of something useful. —***dissipation*** (*n.*) ***dissipated*** (*adj.*) ↑ SEPARATE[1] · SCATTER (Sn)

AG085 share (*v.t.*) To use or to possess objects, materials, or energy, in common, with the original remaining as a whole, *e.g.* ***a*** two atoms share a pair of electrons (both atoms use the electrons to form a bond; both atoms possess the two electrons for completion of their electron shells); ***b*** the parent birds and their offspring share a nest (they use the nest in common; the nest is not divided, or cut up to give each a portion). —***shared*** (*adj.*) ***share*** (*n.*) ↓ SHARE OUT · DISTRIBUTE ↑ DIVIDE

AG086 share out (*v.t.*) To divide and give a portion or share to an individual or to a unit, *i.e.* the original no longer remains as a whole □ *share out the lime among the pupils* —***share*** (*n.*) ↑ SHARE

AG087 distribute (*v.t.*) **1** To give out portions or shares to different people, or to place portions or items in different locations, *e.g.* ***a*** to distribute books among the pupils (give each pupil a book); ***b*** to distribute a substance between three test tubes (place portions in three different test tubes). **2** To spread along a line, over an area, or throughout a volume, *e.g.* ***a*** electric charge distributes itself uniformly over a surface, ***b*** in an electrolyte ions are distributed throughout the solution; ***c*** the energy of a gas is distributed over the gas molecules (spread out over the molecules so that each molecule has part of the total energy); ***d*** a plant distributed over a wide area □ *objects are distributed among individuals; electrical energy is distributed to consumers; charge is distributed over a surface; ions are distributed throughout a volume* —***distribution*** (*n.*) ***distributed, distributive*** (*adj.*)



DIVIDE & RELATED TERMS

↓ SPREAD² (Sn) ↑ SHARE

AG088 spread² (*v.t.,i.*) **1** (*v.i.*) To separate or move so as to cover an area or to be found throughout a volume, *e.g.* ***a*** electric charge spreads over a conductor (moves so as to cover the surface); ***b*** ions spread through a solution (move so that they are found at all points in the solution); ***c*** plants spread over an area by dispersion of seeds; ***d*** a disease can spread by contact between infected people. **2** (*v.i.*) (*also* ***spread out***) To move further apart, *e.g.* as pressure is reduced on a gas the volume increases and the molecules spread out (move further apart). **3** (*v.t.*) To cause to spread; to cover with a layer of liquid, powder, etc., *e.g.* ***a*** to spread paint on a surface; ***b*** to spread disease. —***spread, spreading*** (*n.*) ***spreading*** (*adj.*) ↓ PROPAGATE · DIFFUSE¹ ↑ CUT · DISPERSE (Sn) · SCATTER (Sn)

AG089 propagate (*v.t.,i.*) **1** (*v.i.*) (Of plants) to spread; to produce new plants, *e.g.* some plants propagate by runners and others by seeds. **2** (*v.i.*) (Of sound, light or other forms of energy) to travel or spread, *e.g.* ***a*** sound propagates by longitudinal pressure waves; ***b*** light propagates by electromagnetic waves. **3** (*v.t.*) To cause to propagate, *e.g.* ***a*** to propagate trees by grafting; ***b*** to propagate sound through air. Compare **propagate** with **transmit**: sound propagates by longitudinal waves through air; sound is transmitted by air. —PROPAGATION (*n.*) ***propagative*** (*adj.*) ↓ DISSEMINATE (Sn) ↑ SPREAD² → PROPAGATION¹ · TRANSMIT

AG090 disseminate (*v.t.,i.*) **1** (*v.t.*) To propagate plants by the dispersal of seeds. **2** (*v.i.*) To spread, usually in a random fashion, but with the implication that a further process will take place, *i.e.* a similarity to the germination of the seed after its dispersal. —***dissemination*** (*n.*) ***disseminated*** (*adj.*) ↑ PROPAGATE (Sn) → SCATTER (Sn)

AG091 diffuse¹ (*v.t.,i.*) **1** (*v.i.*) To move and spread over an area or through a volume by random movement of particles, atoms, molecules or ions, *e.g.* ***a*** smoke diffuses through the air; ***b*** solute molecules diffuse through a solution. The process (**diffusion**) continues by random kinetic motion until all the particles are uniformly spread. **2** (*v.i.*) (Of light) to be scattered in all directions to give uniform indirect illumination rather than direct illumination. **3** (*v.t.*) To cause light to diffuse, *e.g.* by reflection from a rough surface or passage through a translucent material □ *the solute molecules diffused throughout the solvent; the molecules diffused through the liquid* —DIFFUSION (*n.*) ***diffused*** (*adj.*) ↓ RADIATE² · CIRCULATE ↑ SPREAD² (Sn) → EFFUSE

AG092 radiate² (*v.t.,i.*) To spread outwards from a source, *e.g.* ***a*** the sun radiates light and heat; ***b*** a radioactive source radiates either alpha or beta rays, but not both. RADIATION, ***radiator*** (*n.*) ***radiant, radiated*** (*adj.*) ↑ DIFFUSE¹ → EMIT (Sn) · EMANATE

AG093 circulate (*v.t.,i.*) **1** (*v.i.*) To move continuously and repeatedly round a real or imaginary path, *e.g.* ***a*** blood circulates through the heart, arteries, capillaries and veins, repeatedly passing through the heart; ***b*** nitrogen circulates between the atmosphere and the nitrogenous compounds in both living organisms and the soil (an imaginary path). **2** (*v.t.*) To cause to move in this way □ *blood circulates through the arterial and venous systems; cold salt water circulates round a refrigeration system* —CIRCULATION, ***circulator*** (*n.*) ***circulatory, circulated, circulating*** (*adj.*) ↑ DIFFUSE¹ → CYCLE

AG094 break (*v.t.,i.*) **(broke, broken) 1** (*v.i.*) To become smaller parts from a whole; to separate into two parts because of an applied force, *e.g.* ***a*** a glass beaker falls onto the ground and breaks into pieces; ***b*** a force which is too heavy is applied to a rope and the rope breaks into two. **2** (*v.t.*) To cause to become smaller parts or fragments from a whole solid because of an applied force, *e.g.* the metal cylinder fell onto the flask and broke it into small pieces —***breaking*** (*adj.*) ***break*** (*n.*) ↓ SNAP¹ · FRACTURE ↑ CUT

AG095 snap¹ (*v.t.,i.*) **1** (*v.t.*) To break a rigid solid cleanly in two, accompanied by a loud sharp noise, by applying a force. **2** (*v.i.*) To break in this way, *e.g.* a wire snaps under too much tension (a pulling force). —***snapped*** (*adj.*) SNAP (*n.*) ↓ SHATTER ↑ BREAK → RUPTURE

AG096 shatter (*v.t.,i.*) **1** (*v.t.*) To break a solid suddenly into small pieces using a heavy blow or by applied strain. Compare **shatter** with **cleave**: both imply a heavy blow; with shatter, no skill is implied and the result is many fragments; with cleave, skill is required to determine the correct direction, and the solid is separated into two pieces with smooth plane surfaces. **2** (*v.i.*) To break into pieces as a result of a blow or strain □ *to shatter into fragments* —***shattered*** (*adj.*) ↑ SNAP¹ → CLEAVE

AG097 fracture (*v.t.,i.*) **1** (*v.t.*) To cause an irregular break in a rigid solid, without necessarily separating the portions, *e.g.* ***a*** to fracture a piece of glass (cause to break into irregular pieces); ***b*** to fracture a bone (cause an irregular break or crack in the bone). **2** (*v.i.*) To be fractured; to suffer an irregular break —***fracture*** (*n.*) ***fractured*** (*adj.*) ↑ BREAK

AG098 shock (*n.*) A sudden force applied to an object, or a sudden and unexpected harmful event happening to an organism, *e.g.* ***a*** a hammer hitting a piece of metal causes a shock which spreads through the metal; ***b*** being badly bitten by an animal causes a shock to a person □ *a sudden passage of electric current through an animal causes shock* —***shock*** (*v.*) ↓ JAR · SHAKE · COLLIDE¹ · REST¹ · SEVERE · HEAD ON ↑ TRAVEL → CUT · DAMAGE

AG099 jar (*v.t.*) **(jarred)** To shock by a sudden push or collison, *e.g.* amniotic fluid

prevents ***jar*** (*n.*). ↓ JOLT · JERK ↑ SHOCK

AG100 jolt (*v.t.*) To give a sudden push to an object; to cause to move quickly by a force, *e.g.* when a locomotive hits a truck, the truck is jolted forwards. —***jolt*** (*n.*) ↑ JAR

AG101 jerk (*v.t.*) To give a sudden sharp pull on an object, *e.g.* a freely falling weight attached to a trolley by a string passing over a pulley, jerks the trolley into motion. Contrast **jolt** which is a push on an object. —***jerk*** (*n.*) ↑ JAR

AG102 shake (shook, shaken) (*v.t.*) To move an object quickly from side to side, up and down, or backwards and forwards, *e.g.* ***a*** to shake a test-tube; ***b*** to shake a clinical thermometer so that the mercury goes down. —***shake*** (*n.*) ↓ STIR · AGITATE ↑ SHOCK

AG103 stir (*v.t.*) **(stirred)** To move an implement, such as a spoon or other device, in a circular motion in a liquid or powder so that the constituents are mixed together. —***stir, stirrer*** (*n.*) ↑ SHAKE

AG104 agitate (*v.t.*) To cause a fluid to move by shaking the container, *e.g.* ***a*** to agitate a solution in a test-tube by shaking the test-tube; ***b*** to agitate the surface of a liquid by means of a vibrating tuning fork. —***agitation*** (*n.*) ↑ SHAKE

AG105 collide[1] (*v.t.,i.*) (Of two bodies in motion) to meet and hit each other, *e.g.* ***a*** two motor cars in motion collide at a road junction; ***b*** a neutron collides with a nucleus □ *one truck collided with another truck* —***collision*** (*n.*) ↓ STRIKE ↑ SHOCK

AG106 strike (*v.t.*) To hit a stationary object violently, *e.g.* ***a*** a stream of electrons strikes a metal target and X-rays are emitted; ***b*** a hammer of an electric bell strikes a gong. ↑ CC LIDE

AG107 rest[1] (*n.*) A state of being without motion, as seen by an observer, *e.g.* a man observes a block of wood on a table; it is not moving, so it is at rest to the observer □ *the trolley is* at rest *on the table* ↑ SHOCK → STATIONARY · EQUILIBRIUM

AG108 severe (*adj.*) Describes very serious damage or injury to an object or an organism resulting from a force, condition or event, *e.g.* ***a*** severe damage to a motor car usually results from its collision with a fast moving lorry; ***b*** severe drought causes many plants to die; ***c*** he has a severe attack of smallpox and is seriously ill. —***severity*** (*n.*) ***severely*** (*adj.*) ↓ VIOLENT · SLIGHT (Ag) ↑ SHOCK → ACUTE

AG109 violent (*adj.*) Describes an event in which a large quantity of energy is released in a short time, *e.g.* ***a*** a violent reaction takes place when potassium metal is added to water; the potassium melts and the hydrogen takes fire; ***b*** a violent storm caused severe damage; ***c*** a violent collision broke the axle of the motor car. Contrast **severe** where the focus is on the recipient; in **violent** the focus is on the agent. —***violence*** (*n.*) ***violently*** (*adj.*) ↑ SEVERE

AG110 slight (*adj.*) Describes a force, or the effect of a force, which has a small magnitude, *e.g.* ***a*** as the train started slowly, only a slight jolt was felt; ***b*** if the speed of the electrons ejected from the cathode is too low, their slight force is insufficient to produce X-rays from a target. —***slightness*** (*n.*) ↑ SEVERE (Ag)

AG111 head on (*adv.*) Describes the way in which two objects collide when they meet travelling along the same straight line in opposite directions. ↓ SIDEWAYS ON ↑ SHOCK

AG112 sideways on (*adv.*) Describes the way in which two objects collide when one object hits a second object on its side. ↑ HEAD ON

AG113 damage (*v.t.*) To cause an object to be no longer perfect; to cause malfunction, *e.g.* ***a*** the student stretched the spring balance beyond its limit and damaged the spring; ***b*** the microscope was damaged when it fell to the ground, as the base was bent; ***c*** lack of vitamin B_1 damages the liver. —***damage*** (*n.*) ***damaged*** (*adj.*) ↓ INJURE · DETERIORATE · DETRIMENT · HARMFUL · HARMLESS · WORN ↑ TRAVEL · SHOCK

AG114 injure (*v.t.*) To cause an individual or organ to be no longer perfect, *e.g.* the man's leg was injured when he fell from the window (the leg could suffer abrasions, scratches, broken bones, etc.). The term is used for all external occurrences and general internal occurrences. Specific organs and tissues require the term **damage**, *e.g.* the man had severe internal injuries and his left kidney was badly damaged. —INJURY (*n.*) ↓ HARM · IMPAIR[1] · DEGRADE · DESTROY ↑ DAMAGE

AG115 harm (*v.t.*) To cause damage or injury; the focus is on the agent causing damage or injury. Contrast both **damage** and **injury** where the focus is on the recipient, *e.g.* ***a*** a snake will not harm a person if he does not attack it; ***b*** overloading harms a spring balance (focus on overloading) as it damages the spring (focus on spring) —***harm*** (*n.*) HARMFUL, HARMLESS (*adj.*) ↑ INJURE

AG116 impair[1] (*v.t.*) To cause any object or process to function less well, *e.g.* ***a*** a faulty transistor impairs the functioning of a radio; ***b*** a heavy blow on the ear impaired his hearing (his ear did not function properly). ↑ INJURE

AG117 degrade (*v.t.*) **1** To make a chemical compound simpler by decomposition, *e.g.* to degrade proteins into amino acids (simpler compounds). **2** To break an aggregate of particles into particles, *e.g.* rocks are degraded by weathering into rock particles. **3** To reduce a form of energy into a less useful form, *e.g.* chemical energy in fuel is degraded into heat energy. The process involves an increase of entropy. —***degradation*** (*n.*) ***degradable, non-degradable*** (*adj.*) ↑ INJURE → AGGREGATE (I)

AG118 destroy (*v.t.*) To bring to an end the independent existence of an object, organism, property, configuration, process or sequence, *e.g.* ***a*** the magnetism of a bar magnet is destroyed by heating; ***b*** the box was destroyed by fire; ***c*** a crystal lattice is

destroyed when a crystal dissolves in a solvent. —***destruction*** (*n.*) DESTRUCTIBLE, INDESTRUCTIBLE, DESTRUCTIVE (*adj.*) ↑ INJURE

AG119 deteriorate (*v.i.*) To become slowly less effective, efficient or useful; (of conditions) to become worse in a continuous fashion, *e.g.* ***a*** a dry cell deteriorates with storage; ***b*** the magnetic properties of a magnet deteriorate if it is dropped often; ***c*** if the speed of the wind increases, conditions for flying deteriorate. Contrast **deteriorate** and **impair**: hearing deteriorates with age (no agent, focus on process), while a heavy blow on the ear may impair hearing (focus on agent). —***deterioration*** (*n.*) ↓ DEGENERATE[1] · DECLINE[2] ↑ INJURE

AG120 degenerate[1] (*v.i.*) **1** (Of organs or tissues) to function less well, *e.g.* increasing presence of fat in the liver causes it to degenerate. **2** To become less complex in organization or structure; to become less advanced, *e.g.* many parasites have degenerated from free-living ancestors. Degeneration, in this sense, is the opposite of **evolution. 3** To fall to a lower potential energy. —DEGENERATION, DEGENERACY (*n.*) DEGENERATE, DEGENERATIVE (*adj.*) ↑ DETERIORATE

AG121 decline[2] (*v.i.*) To decrease continuously in number or efficiency; declining is a continuous process and implies that a peak has been reached and passed, *e.g.* the birth-rate declines when the number of live births continuously decreases □ *the population in Europe is* declining steadily; *last year there was a* sharp decline *in the death rate* —***decline*** (*n.*) ***declining*** (*adj.*) ↑ DETERIORATE → DECREASE · RISE (An)

AG122 detriment (*n.*) The result of an object, organism, process, property, or configuration being impaired. The focus is on the recipient; contrast **harm** where the focus is on the agent, *e.g.* ***a*** the student overloaded the spring balance to the detriment of the spring (focus on the spring); ***b*** he received a heavy blow on the ear to the detriment of his hearing (his hearing was impaired) □ *his activities were* to the detriment of *his health* —DETRIMENTAL (*adj.*) ↓ DEGENERATION · DEGENERACY ↑ IMPAIR[1] · DAMAGE

AG123 degeneration (*n.*) The process of degenerating, *e.g.* the degeneration of the peripheral nervous system that takes place in leprosy. ↑ DETRIMENT

AG124 degeneracy (*n.*) The state reached after a process of degeneration. ↑ DETRIMENT

AG125 harmful (*adj.*) Describes an agent causing harm, *e.g.* aspirin in large quantities can be harmful to the digestive organs. ↓ DETRIMENTAL · DESTRUCTIBLE · INDESTRUCTIBLE · DESTRUCTIVE · DEGENERATIVE DEGENERATE[3] ↑ DAMAGE → HARMLESS (An)

AG126 detrimental (*adj.*) Describes events, processes, or conditions which impair objects or organisms; the focus is on the recipient, *e.g.* the loudness of the explosion had a detrimental effect on his hearing □ *noise is detrimental to hearing* ↑ HARMFUL

AG127 destructible (*adj.*) Describes any object or material that may be destroyed. ↓ INDESTRUCTIBLE (I) ↑ HARMFUL

AG128 indestructible (*adj.*) Describes an object that cannot be destroyed, *e.g.* ***a*** some types of plastics are indestructible by all known chemical or biological agents; ***b*** teeth, unlike bones, are indestructible by fire □ *glass is* indestructible by *most concentrated acids* ↑ HARMFUL · DESTRUCTIBLE (I)

AG129 destructive (*adj.*) Describes an agent that destroys, *e.g.* ***a*** a destructive explosion is one that destroys all objects near it; ***b*** concentrated nitric acid is a destructive chemical. —***destructiveness*** (*n.*) ↑ HARMFUL

AG130 degenerative (*adj.*) Describes an agent leading to, or causing, degeneracy, *e.g.* leprosy is a degenerative disease as it causes degeneracy of the peripheral nervous system. ↑ HARMFUL

AG131 degenerate[2] (*adj.*) Describes an organism, organ, tissue or form of energy which has gone through a process of degeneration and reached a state of degeneracy. ↑ HARMFUL

AG132 harmless (*adj.*) Describes any agent which is not capable of causing harm, *e.g.* ***a*** grass snakes are harmless; ***b*** raw eggs are a harmless antidote to many poisons; ***c*** salt is a harmless chemical. ↑ DAMAGE → HARMFUL (An)

AG133 worn (*adj.*) Reduced in size and hence weak or impaired by constant use, *e.g.* the axle of a pulley is worn by use and should be replaced. —***wear*** (*n.*) ***wear*** (*v.*) ↓ WORN-OUT ↑ DAMAGE → EROSION

AG134 worn-out (*adj.*) Describes an object which has worn so much that it is no longer of any use, *e.g.* the bicycle tyre is worn-out and must be replaced. Compare **worn** which may imply the possibility of repair but worn-out is used when the object cannot be repaired. ↑ WORN

AG135 improve (*v.t.,i.*) **1** (*v.i.*) To become better in function, *e.g.* ***a*** when a shunt is used the sensitivity of an ammeter improves; ***b*** soil improves when fertilizer is added. **2** (*v.t.*) To make better, *e.g.* ***a*** the use of a shunt improves the sensitivity of an ammeter; ***b*** the addition of humus improves the quality of soil. —***improvement*** (*n.*) ↓ PROGRESS · ENRICH · RETREAT · AID[2] · UNAIDED ↑ TRAVEL

AG136 progress (*v.i.*) To go from one stage to the next, usually implying improvement towards an aim or movement forward in space as seen by an observer, *e.g.* ***a*** a child progresses from crawling to walking to running (improvement implied); ***b*** as the experiment progresses more results are obtained □ *the method progresses from simple stages to difficult stages* —***progression*** (*n.*) ***progressive*** (*adj.*) ↓ ADVANCE · ENHANCE · AID[1] · ASSIST

↑ IMPROVE

AG137 advance (*v.t.,i.*) **1** (*v.t.*) To cause to move forward in space or in time, *e.g.* ***a*** when the ignition system of a motorcar is advanced, the petrol/air mixture is sparked before the piston has completed the compression stroke; ***b*** the work of J. J. Thomson advanced scientific knowledge. **2** (*v.i.*) To become better, *e.g.* scientific knowledge advanced because of Einstein's theory of relativity. —***advance, advancement*** (*n.*) ***advanced*** (*adj.*) ↑ PROGRESS → RETREAT (1)

AG138 enhance (*v.t.*) To increase or improve an existing effect or process, *e.g.* anti-diuretic hormone enhances water retention by the kidney (the process exists already, and the retention is increased). —***enhancement*** (*n.*) ↑ PROGRESS

AG139 aid[1] (*v.t.*) To give indirect help by means of an object or device, *e.g.* ***a*** spectacles aid a person's vision; ***b*** a catalyst aids a reaction to take place more quickly although it does not itself take part in the reaction; ***c*** fertilizers aid the growth of plants. The focus is on the object or device. To contrast **help** and **aid**: spectacles aid a person's vision (focus on spectacles) but a person's vision is helped by spectacles (focus on the vision, as the focus in helping is on the recipient). ↑ PROGRESS

AG140 assist (*v.t.*) To give direct help by taking part in a process, but being of secondary importance, *e.g.* ***a*** a promoter assists a catalyst in a chemical reaction, *i.e.* the catalyst is of primary importance and the promoter of secondary importance; ***b*** a bright light assists the eyes to read small print (the light takes part in the process). To contrast **aid** and **assist**: exercise aids the digestion of food (exercise does not take part in the digestion) while roughage in the diet assists digestion (the roughage takes part, although a subsidiary part, in promoting peristalsis). —***assistance*** (*n.*) ↑ PROGRESS

AG141 enrich (*v.t.*) To raise the proportion of an important constituent in a mixture, *e.g.* ***a*** to enrich a mixture of petrol and air by supplying more petrol or less air, so that the mixture is enriched with petrol; ***b*** to enrich sulphide ores by concentrating by flotation of the sulphide required for extraction of the metal. —***enrichment*** (*n.*) ↓ RENEW ↑ IMPROVE

AG142 renew (*v.t.*) To replace a worn-out part or a non-functioning device by a new part or device, *e.g.* ***a*** to renew a washer on a tap is to put a new washer in place of the worn-out washer; ***b*** to renew a burnt-out fuse. —***renewal*** (*n.*) ↑ ENRICH → REPLACE[1]

AG143 retreat (*v.i.*) To go back from a position because of an opposing force or adverse factor, *e.g.* the larvae of houseflies retreat from sunlight. ↓ WITHDRAW · RETARD ↑ IMPROVE → ADVANCE (1)

AG144 withdraw (*v.t.*) **(withdrew, withdrawn)** To remove an object from within a place or from a position; the focus is on the action, *e.g.* after stinging its victim, a wasp withdraws the sting. To contrast **remove** and **withdraw**: air is removed from the bell jar leaving a vacuum; air is withdrawn from the bell jar using an electric pump, but a vacuum is not necessarily formed. —***withdrawal*** (*n.*) ↑ RETREAT

AG145 retard (*v.t.*) To make a process or motion become slower, *e.g.* ***a*** the presence of an inert gas in an electric lamp bulb retards the ejection of electrons from the hot filament; ***b*** friction between surfaces retards the motion of an object sliding down an inclined plane. —***retardation*** (*n.*) ↑ RETREAT

AG146 aid[2] (*n.*) An object or device which aids a process, *e.g.* ***a*** a visual aid is an object which aids the process of learning; ***b*** a hearing aid is a device which aids the process of hearing. ↑ IMPROVE

AG147 unaided (*adj.*) Describes a sense or a process which operates without an aid, *e.g.* observation by the naked eye, without the aid of a microscope or hand lens, is observation by unaided vision. ↑ IMPROVE

AG148 possess (*v.t.*) To have, with the disposition to lose, transfer or change, *e.g.* ***a*** a metal sphere after contact with a charged rod possesses an electric charge itself (the sphere can lose the charge); ***b*** a body in motion possesses kinetic energy (the energy can change on collision). To contrast **have** and **possess**: a particle in a colloidal solution has mass (which it cannot lose) and usually possesses charge (which it can lose). —***possession*** (*n.*) ↓ OBTAIN[1] · DONATE · RECOVER[2] ↑ TRAVEL

AG149 obtain[1] (*v.t.*) To get an object, substance, or energy from a source purposefully and using an agent; the agent is not necessarily stated, *e.g.* ***a*** we obtain hydrogen from an acid using zinc as an agent for the reaction; ***b*** we obtain electrical energy from a primary cell; ***c*** the body obtains amino acids from protein using digestive enzymes as agents □ *hydrogen is obtained from hydrochloric acid; hydrogen is obtained by the action of zinc on hydrochloric acid* ↓ ACQUIRE ↑ POSSESS

AG150 acquire (*v.t.*) **1** To get by means of a process or a change in property or configuration, *e.g.* when a glass rod is rubbed with a silk cloth the glass rod acquires an electric charge (the focus is on the process of rubbing to produce a frictional electric charge; the glass rod gets a change in its properties). **2** (Of animals) to get a disposition, *e.g.* a bird acquires the ability to fly. **3** (Of human beings) to get an object, *e.g.* the farmer acquires a piece of land. In each case the focus is on getting by means of a process, although the process is not necessarily indicated or stated. —***acquisition*** (*n.*) ***acquired*** (*adj.*) ↑ OBTAIN[1]

AG151 donate (*v.t.*) To give to when the circumstances are suitable or considered suitable, *e.g.* ***a*** a molecule of ammonia donates its lone pair of electrons to a hydrogen ion (the empty *s*-orbital in the hydrogen ion provides the suitable circum-

stances); *b* the man donates blood to a patient in hospital (the patient is of a compatible blood group, *i.e.* the suitable circumstances for transfusion). —***donor, donation*** (*n.*) ↓ ACCEPT (Cs) · REJECT · RETAIN · IMPART[1] ↑ POSSESS

AG152 accept (*v.t.*) **1** To take an object when it is donated, *e.g.* *a* a molecule accepts a lone pair of electrons from a donor atom; *b* a patient's body accepts a blood transfusion from a donor. **2** To agree with a statement after examining the evidence in support of the statement, *e.g.* to accept Ohm's Law as true after examining the experimental evidence. —***accept, acceptance, acceptability*** (*n.*) ***acceptable, accepted*** (*adj.*) ↓ REJECT (I) ↑ DONATE

AG153 reject (*v.t.*) **1** To throw away an object or material that is not wanted, *e.g.* a carnivorous animal rejects substances, such as cellulose, which it cannot digest. **2** To refuse to accept, *e.g.* *a* the tissues of an animal may reject organs transplanted from a donor; *b* X-rays are used to examine the thickness of sheet metal, and the machine rejects specimens with a thickness outside the limits of suitability; *c* Lavoisier rejected previous theories of oxidation processes, as he refused to accept the theories after examining the evidence. —***rejection*** (*n.*) ↑ DONATE · ACCEPT (I)

AG154 retain (*v.t.*) To continue possessing an object, substance, property or energy, when there is the disposition to lose the object, etc., *e.g.* *a* a charged electroscope retains its charge provided the insulation at its base is adequate, so that the charge does not leak to earth; *b* after collision, the truck still retained some of its kinetic energy; *c* lagging retains heat in steam pipes. —***retention, retentivity*** (*n.*) ↑ DONATE

AG155 impart[1] (*v.t.*) To share a quality with an object, *e.g.* *a* a sodium salt heated in a flame imparts a golden yellow colour to the flame; *b* when a truck in motion collides with a stationary truck, it imparts energy to the stationary truck; *c* garlic imparts its flavour to food. ↑ DONATE

AG156 recover[2] (*v.i.*) To return to an initial state, *e.g.* *a* after stretching a spring within its limit of elasticity, it recovers to its original length; *b* after being ill with malaria a patient recovers to full health providing he receives correct medical care. —***recovery*** (*n.*) ↑ POSSESS

Time

AH001 time[1] (*n.*) **1** The measurement by which it is possible to judge how quickly or how slowly a change occurs. We think of time as something passing from past to future irreversibly and we are aware of it passing by observing changes or processes, *e.g.* time passes as an organism grows older or as a piece of wood burns. Time is a continuous dimension in which events occur (to give a full description of any event it is necessary to describe its position, using the dimensions of space, and its time). Time is measured by comparison with a standard, such as the swing of a pendulum, the rotation or revolution of the earth, or the vibration of a standard frequency of electromagnetic radiation. **2** The passing of time during a given change or between two given events, *e.g.* *a* the time of growth was two weeks (while growth was taking place two weeks passed); *b* the time between the start of the chemical reaction and its end was six minutes. A definite part of time (as measured between two events) is called a **length of time** or a **period of time.** **3** A point on a scale measuring time, usually measured from some arbitrary starting point, *e.g.* the time when the liquid started to boil was recorded (measured from the start of the experiment) A definite point is called a **point in time** or a **point of time**. The **time of day** is a point in time measured in hours, minutes, and seconds from midnight or midday, *e.g.* the time of the lecture is 10 o'clock. **4** (*often* **times**) A period of time (usually years) in the past in which there were similar conditions. The history of the earth is measured on a geographical time scale using very large units of time. **5** A method of measurement of time, *e.g.* *a* solar time (time measured by the sun); *b* sidereal time (time measured by the stars); *c* atomic time (time measured by the spectra of atoms) □ *time passes as changes occur; the time taken for the experiment was three minutes; the elapsed time was three minutes* —TIME (*v.*) ***timed*** (*adj.*) ↓ PERIOD[1] · EVENT · AGE · ORIGIN[1] · ELAPSE · LATENT · EVENTUAL · PERIODIC[1] · STAGE → PROCESS[1] · NEED[1] · ORDER

AH002 period[1] (*n.*) **1** A length of time; the time passing during a change or between two events, *e.g.* *a* the half-value period of a radioactive element is the time taken for decay of 50% of the original amount; *b* the liquid was heated continuously for a period of six hours; *c* unstable fundamental particles exist for a very short period of time. **2** The time taken for one complete stage (cycle) in a process that repeats itself, *e.g.* the period of a pendulum is the time from the beginning to the end of one oscillation. —PERIODICITY (*n.*) PERIODIC (*adj.*) ↓ DURATION · INTERVAL[1] ↑ TIME[1]

AH003 duration (*n.*) The period of time which marks the extent of a process, *e.g.* the duration of the chemical reaction between

nitrogen and hydrogen is the period of time taken for the equilibrium mixture to be formed from the reactants. To distinguish **extent** and **duration**: the extent of the academic year is from September to June; its duration is 10 months (extent states the limits in time, duration is a measure of the time). —***durability*** (*n.*) DURABLE (*adj.*) ↑ PERIOD[1] → EXTENT

AH004 interval[1] (*n.*) A period of time between two events or the space between two points, *e.g.* ***a*** antibiotics must be taken at regular intervals (every four hours); ***b*** the posts in a fence are put in at regular intervals (every two metres). ↑ PERIOD[1]

AH005 event (*n.*) Any change or occurrence that takes place at a definite place and time, *e.g.* when heat is supplied to water it boils; the boiling of the water is an event. **In the event of** (something happening) = if something should happen, *e.g.* in the event of fire, use the fire extinguisher (if there is a fire, use the fire extinguisher). —***eventuality*** (*n.*) ***eventuate*** (*v.*) EVENTUAL (*adj.*) ***eventually*** (*adv.*) ↓ OCCASION ↑ PERIOD → EFFECT

AH006 occasion (*n.*) The time at which an event takes place, *e.g.* on the occasion of the last lunar eclipse, observations were made in both Europe and Asia. ↑ EVENT

AH007 age (*n.*) **1** (G.S.) The number of years for which an object has existed or for which an organism has lived. Small periods of time are not described as an age, *e.g.* a butterfly, living for a day, does not have an age but has a **lifespan**. Subatomic particles and radioactive species are said to have a **half-life**. **2** (Geology) A very long period of time in the history of the earth; a geological age, *e.g.* the carboniferous age which lasted for about 80 million years and occurred about 310 million years ago. **3** Ethnology) A period of time based upon cultural criteria, *e.g.* ***a*** the neolithic age when man made flint implements; ***b*** the iron age after the discovery of iron smelting by the Hittites □ *the man is 40 years of age; the man is aged 40 years* —***age*** (*v.*) ***aged*** (*adj.*) ↓ LIFESPAN · EPOCH · ERA ↑ TIME[1] → GEOLOGY · ETHNOLOGY · RADIOACTIVE · SPECIES

AH008 lifespan (*n.*) The period of time between the birth and the death of an organism, *e.g.* ***a*** the lifespan of a butterfly can be 24 hours; ***b*** the lifespan of man is generally considered to be about 70 years. ↑ AGE

AH009 epoch (*n.*) **1** (In geology) an extent of time which is a sub-division of a Period, *e.g.* the Eocene epoch, which lasted for approximately 20 million years, is a subdivision of the Tertiary Period. **2** (G.S.) Any important period of years, especially one started by an important event, *e.g.* the invention of the telephone opened a new epoch in communications. ↑ AGE

AH010 era (*n.*) **1** (In geology) the largest geological division of time; there are four eras described in the existence of the earth, and each era is sub-divided into Periods, *e.g.* the most recent Era is the Cenozoic Era, divided into the Tertiary and Quaternary Periods. The length of the Cenozoic Era is approximately 90 million years. **2** (G.S.) Any important period of years, especially one noted for some special conditions or events, *e.g.* the era of space exploration. ↑ AGE

AH011 origin[1] (*n.*) A beginning from which something has developed or been formed. The origin of something is the cause of its existence, *e.g.* ***a*** the origin of coal is plant remains deposited some 300 million years ago; ***b*** in his book *The Origin of Species* Darwin discussed how different species had developed from common ancestors (by evolution). Note the difference between **origin** and **source**: origin stresses the beginning of something in the past, *e.g.* the origin of coal 300 million years ago. Source is usually used for the place from which something comes, *e.g.* a coal mine is a source of coal □ *crude oil has its* origin in *decayed animal remains* —ORIGINATE (*v.*) ***original*** (*adj.*) ↓ SOURCE[1] ↑ PERIOD[1]

AH012 source[1] (*n.*) A place from which something comes or is emitted. A source is not restricted to a point in time; it can be past, present or future, *e.g.* ***a*** a metal at a high temperature is a source of light and a source of electrons (the light and the electrons are emitted); ***b*** at one time, wood was the main source of heat; at present, coal and oil are the main sources of heat and energy; in the future, atomic fusion may be the main source of energy □ *sea-water is a major source of salt; the Gossage process is a minor source of sodium hydroxide; hydrogen fusion is a potential source of energy; the sea is an unlimited source of bromine* ↑ ORIGIN[1]

AH013 elapse (*v.i.*) (Of time) to pass unobserved, especially for a specific period, *e.g.* an observer sets up an experiment on osmosis; he allows time for an osmotic rise to reach an equilibrium with the solution; during that time the observer carries out another activity – the observer has allowed time to elapse for the experiment on osmosis. —***lapse*** (*n.*) ↓ INTERRUPT ↑ TIME[1]

AH014 interrupt (*v.t.*) To make a break in a process or series of events if the process or series of events goes on after the break, *e.g.* electric current is interrupted by a make-and-break mechanism, *i.e.* the current is stopped and then started again. —***interruption*** (*n.*) ***interrupted*** (*adj.*) ↑ ELAPSE

AH015 latent (*adj.*) Present but not active or perceived, *e.g.* a latent image on a photographic film is one that cannot be seen (developing the film makes the image visible). Contrast **potential**: there may be a latent source of oil under the sea, although it has not yet been discovered; if it is discovered, but not used, it becomes a potential source of oil. ↓ TEMPORARY · PERMANENT[1] · DURABLE · PERPETUAL · PROTRACTED ↑ TIME[1] → LATENT HEAT

AH016 temporary (*adj.*) Describes an object or condition that exists for a limited

time, the limits of time depending on the circumstances, *e.g.* a small wooden hut can be used as a temporary classroom until a new school is built. ↓ PERMANENT[1] (I) ↑ LATENT

AH017 permanent[1] (*adj.*) Describes an object or condition that exists for an unlimited time according to the circumstances, *e.g.* a house is permanent because it is built of durable materials (the durable materials are the factor in the circumstances and the house lasts as long as the materials do). —***permanence*** (*n.*) ↑ LATENT · TEMPORARY (I)

AH018 durable (*adj.*) Capable of lasting a long time; not wearing or perishing easily, *e.g.* a stone or a wall made of stone is durable. —***durability*** (*n.*) ↑ LATENT → PERISHABLE (I)

AH019 perpetual (*adj.*) Describes a movement or process that continues without end; **perpetual motion** – continuous motion without an external source of energy – is denied by the second law of thermodynamics. —***perpetuate*** (*v.*) ↑ LATENT → ESTABLISH

AH020 protracted (*adj.*) Describes a process which takes a long period of time, when the process could have been finished in a much shorter time, *e.g.* a protracted experiment on the function of chlorophyll in photosynthesis in which the experiment lasted for five days, although sufficient useful results could have been obtained in two days. —***protraction*** (*n.*) ***protract*** (*v.*) ↑ LATENT

AH021 eventual (*adj.*) Describes a result or state produced by completion of a process or action. The term implies that a period of time passes before the result is reached, *e.g.* the eventual result of exposing a pellet of sodium hydroxide to the atmosphere is sodium carbonate monohydrate crystals. —***eventually*** (*adv.*) ↓ SUDDEN · ABRUPT · INSTANTANEOUS · RAPID · FAST · QUICK · BRIEF ↑ TIME[1]

AH022 sudden (*adj.*) Describes an event or change that takes place without warning or without preparation; the term implies that the event or change takes place very quickly, *e.g.* ***a*** the sudden appearance of smoke from the car engine frightened the driver (the focus is on the quickness of the event); ***b*** the sudden appearance of a precipitate in an ionic reaction (the precipitate appears instantaneously). —***suddenly*** (*adv.*) ↑ EVENTUAL

AH023 abrupt (*adj.*) Describes the breaking off or cessation of a process when the event (breaking-off or cessation) takes place very quickly or instantaneously, *e.g.* applying the brakes quickly brings a car to an abrupt halt (the cessation of motion). The focus is on the quickness of the event and on the time before the event, *e.g.* the motion of the car is under consideration and no consideration is given to events after the halting of the car. Contrast **sudden** and **abrupt**: sudden describes any change that takes place quickly and can be used for processes starting, *e.g.* a sudden explosion. Abrupt is used for the end of a process, *e.g.* the reaction came to an abrupt end, or for a change in a continuing process, *e.g.* an abrupt increase in the rate of reaction. The focus is on events before the change. ↑ EVENTUAL

AH024 instantaneous (*adj.*) Describes an event that takes place with a duration so short that the period is not normally perceptible, *e.g.* the formation of a precipitate when two suitable ions are brought in contact in solution is considered to be instantaneous; it would require very sensitive apparatus to detect the duration of the reaction (of the order of 10^{-4} sec). —***instant*** (*n.*) ↑ EVENTUAL → PROTRACTED (An) · SIMULTANEOUS

AH025 rapid (*adj.*) **1** Describes a repeating event with a high frequency, *e.g.* ***a*** a rapid pulse (a high frequency of heart beat as measured in the wrist or elsewhere); ***b*** the rapid vibration of an insect's wings (a high frequency of vibration). **2** (G.S.) Describes motion or a process that takes place very quickly. —***rapidity*** (*n.*) ***rapidly*** (*adv.*) ↑ EVENTUAL → SLOW (Ag)

AH026 fast (*adj.*) Describes an object in motion or a process in operation when the speed or the rate of change is high, *e.g.* ***a*** a fast car is capable of a high speed; ***b*** a fast chemical reaction is capable of a high rate of reaction. ↑ EVENTUAL → SLOW (Ag)

AH027 quick (*adj.*) Describes a movement or process which has a short duration, *e.g.* ***a*** the reaction is quick to reach equilibrium (the time taken to reach equilibrium is short); ***b*** a quick jump by an animal on to its prey. —***quickness*** (*n.*) ***quickly*** (*adj.*) ↑ EVENTUAL → SLOW (Ag)

AH028 brief (*adj.*) Describes a short duration; the term is also applied to processes, *e.g.* writing a brief account means that the process should be of short duration, *i.e.* not too much time should be spent on it but it should be complete □ *a brief interval of time.* —***brevity*** (*n.*) ***briefly*** (*adj.*) ↑ EVENTUAL → EXTENDED (Ag) · PROTRACTED (Ag)

AH029 periodic[1] (*adj.*) Describes an event that occurs at regular intervals of time, the interval of time being a period, *e.g.* ***a*** the periodic motion of the earth round the sun (occurs at regular intervals of the year); ***b*** the periodic alternation of a current in alternating current (the potential of the supply changes from a maximum, to a minimum, to a maximum, in a defined period of time); the focus is on the regular intervals of occurrence. —***periodicity*** (*n.*) ***periodically*** (*adv.*) ↓ INTERMITTENT · SLOW ↑ TIME[1] → APERIODIC (Cn)

AH030 intermittent (*adj.*) Describes a process or series of events which take place at intervals of time, *i.e.* the process or series of events is interrupted from time to time. The focus is on the interrupted nature of the process or series of events, *e.g.* ***a*** an electrical interrupter gives an intermittent current;

b the light from a traffic indicator on a car is intermittent (the indicator has a continual display for the time it is switched on but the light appears at intervals; ***c*** an intermittent current is always in the same direction but flows for an interval and is then interrupted and this state of affairs is repeated. —***intermittently*** (*adv.*) ↑ PERIODIC[1]

AH031 slow (*adj.*) **1** Describes a repeating event with a low frequency, *e.g.* a slow pulse (a low frequency of heart beat as measured on the wrist). **2** Describes a movement or process which has a long duration, *e.g.* the reaction is slow to reach equilibrium (the time taken to reach equilibrium is long). **3** Describes an object in motion or a process in operation when the speed or rate of change is low, *e.g.* a slow chemical reaction is only capable of a low rate of reaction. —***slowness*** (*n.*) ***slow down*** (*v.*) ↑ PERIODIC[1] ↑ QUICK (Ag) · FAST (Ag) · RAPID (Ag)

AH032 stage (*n.*) A division in space or time in a particular piece of work, or in a particular process, or in the development of a particular organism, *e.g.* ***a*** a bus route is divided into stages (there are actual lengths of road along which a bus travels); ***b*** there are four stages in the life cycle of certain insects (development of an organism); ***c*** the stages in the contact process are (i) purification of raw materials (ii) passage through the heat exchanger (iii) the catalysed reaction (iv) absorption of the product (four stages in a process). —***staging*** (*n.*) ↓ RECUR[1] · FOLLOWING · SIMULTANEOUS · PRIMITIVE ↑ TIME[1]

AH033 recur[1] (*v.i.*) (Of an event) to occur again either once or several times, as a result of a predictable natural process, *e.g.* in some types of malaria a fever recurs every forty-eight hours (a natural process, with no apparent agent, and the event is predictable). —***recurrence*** (*n.*) ***recurrent*** (*adj.*) ↓ REPEAT ↑ STAGE → OCCUR

AH034 repeat (*v.t.*) To do or say something again, *e.g.* ***a*** the man repeated the experiment; ***b*** the process was repeated with greater success. —***repetition*** (*n.*) ***repetitive, repetitious*** (*adj.*) ↑ RECUR[1]

AH035 following (*adj.*) Describes objects or events that follow other objects or events in space or time. —***follow*** (*v.*) ↓ SUCCESSIVE · SUCCEEDING · CONSECUTIVE · CONTINUOUS · CONTINUAL · CONTINUOUSLY · CONTINUALLY ↑ STAGE → ORDER

AH036 successive (*adj.*) Describes similar states of affairs following one another in time, *e.g.* ***a*** carrying out successive experiments (one experiment is carried out at a time and the experiments are carried out one after the other); ***b*** insects follow successive stages of development in their life cycles (the stages are states of affairs and follow one another in time). —SUCCESSION (*n.*) ***succeed*** (*v.*) SUCCEEDING (*adj.*) ***successively*** (*adv.*) ↑ FOLLOWING

AH037 succeeding (*adj.*) Describes a state of affairs which follows another, *e.g.* if B follows A then B is the succeeding state of affairs after A. —***succeed*** (*v.*) ↑ FOLLOWING

AH038 consecutive (*adj.*) Describes similar events in a defined order in which one event follows immediately after another event, *e.g.* ***a*** the seven consecutive segments (9 to 15) of the earthworm contain the gonads (all segments are joined one immediately after the other); ***b*** obtaining three consecutive burette readings which only differ by 0·2 cm^3 (the readings are written down and are perceptible at the same time; they are only consecutive when taken as a whole set). Contrast **successive and consecutive**: in 1967, 1968, 1969 the harvests were poor; they were *successive* harvests in three *consecutive* years. The harvest is a state of affairs appearing at three different times; the years follow immediately one after the other. ↑ FOLLOWING

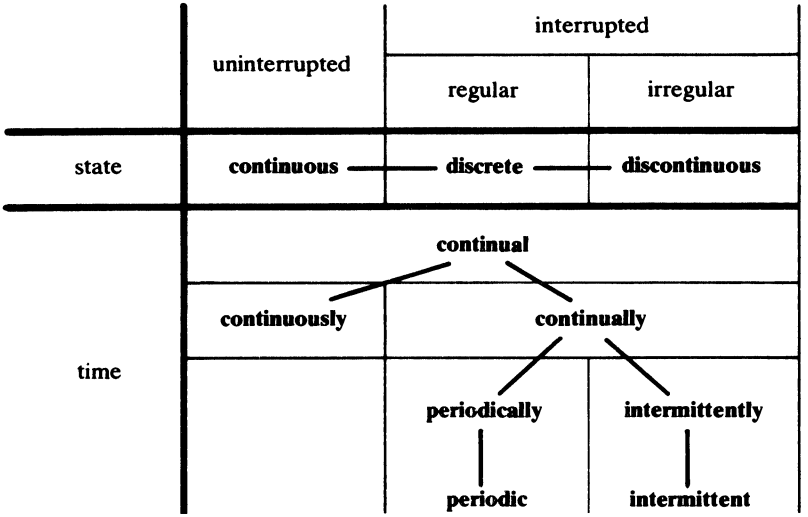
AH039 continuous (*adj.*) Describes matter or energy that goes on without a break, *e.g.* ***a*** a continuous line is one without a break; ***b*** a continuous flow of water from a tap (matter without a break); ***c*** a continuous flow of electricity from a cell (energy without a break); ***d*** continuous flow methods of measuring specific heat capacity (this depends on the substance flowing without break); ***e*** a continuous supply of oxygen (matter without a break). ↑ FOLLOWING

AH040 continual (*adj.*) Describes a state of affairs that goes on in time, *e.g.* ***a*** continual rain can cause a flood (a state of affairs going on for a long time); ***b*** an electric battery provides a continual source of electrical energy (the source goes on in time); ***c*** fertility of the soil is said to depend on the continual existence of earthworms in the ground (a state of affairs going on in time). Contrast **continuous** and **continual**: the continuous flow of water (matter without a break) through a dam provides a continual source (state of affairs in time) of hydroelectric power. ↑ FOLLOWING

AH041 continuously (*adv.*) Describes a process or series of events that continue without interruption, *e.g.* ***a*** a bell rings continuously if it does not stop at all (although it is described as a **continual** ringing of the bell as it goes on in time); ***b*** an electric cell supplies current continuously to a connected circuit (the flow of electric current is continuous and without interruption). —***continue*** (*v.*) CONTINUOUS (*adj.*) ↑ FOLLOWING

AH042 continually (*adv.*) Describes a process or series of events that continues with interruption, *e.g.* ***a*** a bell rings continually if it rings and stops, rings and stops, and so on; ***b*** the dog barked continually for three hours (because he took a breath between each bark). The focus is on the duration of the process or series of events. —***continue*** (*v.*) CONTINUAL (*adj.*) ↑ FOLLOWING

AH043 simultaneous (*adj.*) Describes two or more events taking place at the same time as far as an observer can perceive (the



CONTINUOUS & RELATED TERMS

observer and the events must be in the same frame of reference). This is the case in most practical observations. If the frames of reference are in motion with respect to one another then more complex considerations are involved. —***simultaneity*** (*n.*) ↓ PRECEDING ↑ STAGE → ORDER · INSTANTANEOUS (Sn)

AH044 preceding (*adj.*) Describes an event or a position in a sequence which comes immediately before an event or a position under reference, *e.g.* in the sequence 2, 4, 6, 8, 10, 12, if 10 is the number under reference then 8 is the preceding term and 2, 4, 6, 8, are the preceding terms. (Note 2, 4, 6, are not preceding terms unless the number 8 is included). ↑ SIMULTANEOUS

AH045 primitive (*adj.*) **1** Describes the earliest stages in the development of a biological structure or of a species of organism which has not evolved in comparison with other related organisms, *e.g.* ***a*** the primitive wing bud of a very young bird; ***b*** the king crab is a primitive creature as it has existed in its present form, *i.e.* not evolved, for millions of years. **2** Describes a very simple process when more advanced processes are available, *e.g.* a primitive method of refining copper by stirring the molten metal with poles of green wood. —***primitiveness*** (*n.*) ↓ OBSOLETE[1] · MODERN · UP TO DATE ↑ STAGE → PRIMORDIA

AH046 obsolete[1] (*adj.*) Describes a device, tool, instrument or term, which is no longer used, or is no longer in existence, *e.g.* ***a*** a tangent galvanometer was an instrument used to measure electric current but it is now obsolete as it has been replaced by the moving coil galvanometer; ***b*** the term 'condenser' is now obsolete as it has been replaced by the term 'capacitor'. —***obsolescence*** (*n.*) ↑ PRIMITIVE → OBSOLETE[2]

AH047 modern (*adj.*) Describes nomenclatures, systems, methods, hypotheses, theories, terms and objects which are in use at the present time, *e.g.* ***a*** the modern system of measurement uses SI units (in contrast to the CGS system which is now obsolete); ***b*** in modern nomenclature copper (II) sulphate has replaced the obsolete cupric sulphate; ***c*** in modern theory on atomic structure, electrons occupy orbitals. —***modernize*** (*v.*) ↓ UP TO DATE (Sn) ↑ PRIMITIVE · OBSOLETE[1] (An)

AH048 up to date (*adj.*) Describes methods, hypotheses, theories and terms which have only just come into existence. An up-to-date method is the newest of modern methods. ↑ PRIMITIVE · MODERN (Sn)

Process

AJ001 process[1] (*n.*) **1** A continuous change made up of a connected and related series of events; a process has a beginning in time and a completion, when the process stops (this is the definition used in the description of terms in this book). **2** In chemistry the

term has a restricted meaning used to describe the manufacture, preparation, or isolation of compounds, *e.g.* ***a*** the Haber process for manufacturing ammonia; ***b*** the preparation of ethyl ethanoate (acetate) includes the processes of refluxing the reactants, distilling the product, and purifying the product. —PROCESS (*v.*) ↓ OPERATION · BEHAVIOUR[1] · BARRIER · DERIVE[1] · PREVENT · OPERATIVE · SIMPLE · INVOLVED IN · ACTION[1] · USE · NEED[1] → TIME · EVENT

AJ002 operation (*n.*) **1** The act or state of working. The operation of a machine, apparatus, device, etc., is the actual process of working, *e.g.* the operation of an ignition coil in a motor car makes the spark that ignites the fuel (the function of the coil is to make the spark but the spark only occurs when the coil is **in operation**). **2** A step in a practical process, *e.g.* ***a*** the preparation of ethanol is completed in two operations, *i.e.* the reaction to produce ethanol and its purification; ***b*** the focussing of a microscope is an operation □ *the chemical plant is in full operation this year and was in partial operation last year; the chemical plant can be* put into operation —OPERATE (*v.*) OPERATIONAL (*adj.*) ***operative*** (*adj.*) ↓ METHOD · PROCEDURE · ROUTINE · PREPARATION · PRODUCT[1] · PRODUCTION ↑ PROCESS[1] → FUNCTION

AJ003 method (*n.*) A particular way of operating or of carrying out a process, *e.g.* ***a*** the method of locomotion of a fish (the way a fish moves); ***b*** a method of finding the focal length of a lens (one particular process for finding the focal length); ***c*** the simplest method of preparing copper (II) sulphate in the laboratory is from copper (II) oxide and dilute sulphuric (VI) acid ($H_2SO_{4(aq)}$). —***methodical*** (*adj.*) ↓ MODE ↑ OPERATION → SYSTEM · RULE

AJ004 procedure (*n.*) The practical steps followed when carrying out a process, *e.g.* the procedure for the neutralization of a given volume of hydrochloric acid with sodium hydroxide solution (specific details on the use of a pipette and a burette etc. are needed). Compare the **method** of preparing sodium chloride in which hydrochloric acid is neutralized with sodium hydroxide solution. Detailed practical steps are not given □ *the procedure to be followed includes crystallization; in spite of carrying out the correct procedure, the experiment failed; an incorrect procedure may result in a poor yield or may produce a bad result* ↓ ROUTINE (Sn) ↑ OPERATION

AJ005 routine (*n.*) A procedure which has been developed for repeated use, *e.g.* the routine to be followed when analysing a mixture of chemical compounds. ↑ OPERATION · PROCEDURE (Sn)

AJ006 preparation (*n.*) **1** The stages in preparing an object, *e.g.* the preparation of a solution for titration involves cleaning the apparatus, weighing the solute, making the solution. **2** A substance prepared for a reason or a definite purpose, *e.g.* ***a*** a specimen of ethyl ethanoate obtained by experiment is a preparation; it can be used to find the properties of the substance or to give evidence of a student carrying out suitable practical work; ***b*** pharmaceutical drugs are known as preparations. ↑ OPERATION

AJ007 product[1] (*n.*) The end result of a process is its product. In a manufacturing process the results can be a **main product**, a **by-product** or a **waste-product**, *e.g.* the product of the Haber process is liquid ammonia; it is the only product, so it is not called the main product; ***b*** in the Castner-Kellner process for manufacturing sodium hydroxide by an electrolytic method, the main product was originally sodium hydroxide, while hydrogen and chlorine were by-products, but now chlorine is the main product and the others are by-products. ↑ OPERATION

AJ008 production (*n.*) The making of a product, usually restricted to manufacturing processes or mining processes, *e.g.* the production of sodium hydroxide is mainly carried out by an electrolytic process and not by the Gossage process. The focus is on obtaining the product. Contrast **operation** in which the focus is on carrying out the process, *e.g.* the operation of the Castner-Kellner process can be dangerous if either hydrogen or chlorine escapes from the plant, although this would not affect the production of sodium hydroxide. ↑ OPERATION

AJ009 behaviour[1] (*n.*) The reactions or responses of an individual or of a group of organisms to the environment, *i.e.* to light, to sound, to chemicals, to touch, to the presence of other organisms, and also to specific situations, *e.g.* ***a*** the behaviour of insect larvae towards light; ***b*** the mating behaviour of birds. —***behave*** (*v.*) ↓ MODE · WAY · MANNER ↑ PROCESS[1] → REACTION · RESPONSE · STIMULUS · PATTERN · INSTINCT · INNATE · HABIT · REFLEX ACTION

AJ010 mode (*n.*) **1** (Of inanimate objects) a manner in which a process is carried out, *e.g.* the mode of vibration of a spring describes the way in which the spring is vibrating once the vibration has been initiated. Compare the **method** of making a spring vibrate; here an agent is necessary to cause the vibration. **2** (Of animate objects) the manner in which a course of action is followed as the result of instinct or behaviour, *e.g.* the mode of locomotion of a frog on land is by jumping. ↑ BEHAVIOUR[1] → WAY (Sn) · MANNER (Sn)

AJ011 way (*n.*) **1** The series of actions which are carried out when the directions for a process are followed, *e.g.* the correct way to connect a water condenser is to connect the lower entry tube to a tap and the upper exit tube to the drain in a sink □ *the* way in which *the circuit is connected is important* **2** (G.S.) A road, path or direction in which to travel. ↓ MANNER (Sn) ↑ BEHAVIOUR[1]

AJ012 manner (*n.*) **1** The actual actions of a person when following directions or instructions. These actions can be described as

careful or careless, good or poor, etc., *e.g.* the careless manner in which the student conducted his experiment produced poor results □ *the* manner in which *the man tested for starch was very careful.* **2** (Of animals) the way in which they behave, *e.g.* the manner in which some birds feed their young. In this use, **manner** and **way** are interchangeable. ↑ BEHAVIOUR[1] · WAY (Sn)

AJ013 barrier (*n.*) A physical obstruction to the flow of fluid which can be passed over if the force of the flow is sufficiently great, *e.g.* walls made of sand-bags form a barrier against the water from an overflowing river. The term is used in a number of figurative senses, *e.g.* the activation energy barrier is a level of energy which must be reached before a chemical reaction can take place. ↑ PROCESS[1]

AJ014 derive[1] (*v.t.*) To obtain *A* from *B* by a series of steps; the term implies an origin, or a source, or an underlying form, *e.g.* ***a*** the unit of density is derived from the units for mass and volume; ***b*** the formula for the relationship between the pressure and volume of a fixed mass of gas at constant temperature can be derived from experimental evidence; the experimental evidence is the source, the steps in the derivation are (i) measurement and recording of pressures and volumes (ii) plotting graphs of the data (iii) abstracting the mathematical relationship (iv) constructing the formula; ***c*** the general formula for pressure and volume of a gas can be derived from the first principles of the Kinetic Theory of gases; ***d*** methylamine can be derived from methane (the underlying form is the structure of methane) □ *to* derive *a theory* from *facts* —***derivation, derivative*** (*n.*) ***derived*** (*adj.*) ↓ OPERATE · PROMOTE · PROVIDE · MANUFACTURE · PREPARE · PRODUCE[1] · FORM[4] · MAINTAIN · CONTROL · REGULATE · COMPENSATE ↑ PROCESS[1] → DERIVATIVE · DERIVED UNITS · DEDUCE · DETERMINE · DERIVE[2]

AJ015 operate (*v.t.,i.*) **1** (*v.t.*) To make a mechanism function, *e.g.* ***a*** to operate a clutch on a motor car so that it is carrying out its function of engaging the engine with the wheels; ***b*** to operate a machine. **2** (*v.i.*) To take effect; to be carrying out a function, *e.g.* ***a*** hydrogen peroxide operates as a reducing agent on potassium manganate (VII); ***b*** if the ignition coil of a motor car does not operate properly, the engine will not start □ *the clutch* operates on *the transmission of a motor car; sulphur dioxide* operates as *an oxidising agent on hydrogen sulphide; the driving mechanism operates smoothly* ↑ DERIVE[1] → ACTUATE

AJ016 promote (*v.t.*) To initiate and to cause a primary effect to continue until its natural end is reached; the primary effect, in turn, causes a secondary effect, which is observed; an agent promotes the secondary effect, *e.g.* auxin initiates cell elongation in plants and causes it to continue; the elongation causes plant growth; auxin thus promotes plant growth. —***promoter, promotion*** (*n.*) ↑ DERIVE[1] → PROMOTER

AJ017 provide (*v.t.*) To make available material, energy or a state of affairs to meet a specific need or demand, *e.g.* ***a*** trees provide shade (shade is a state of affairs, the shade is available when anyone needs it); ***b*** the insolubility of barium sulphate provides a means of separating barium ions from magnesium ions. Contrast **supply**: the renal artery supplies blood to the kidney (a continuous observable process satisfying a need). —***provision*** (*n.*) ↑ DERIVE[1]

AJ018 manufacture (*v.t.*) **1** (G.S.) To make a product on a large scale by a process having a number of stages; a continuous supply of the product is formed, *e.g.* to manufacture sulphuric acid by the Contact Process. **2** (Bio.) To make a continuous supply of a product by a process having a number of steps; the product is to ensure the functioning of a living organism, *e.g.* starch is manufactured in the leaves of a plant by the process of photosynthesis. —***manufacture*** (*n.*) ↑ DERIVE[1]

AJ019 prepare (*v.t.*) **1** To make an object ready for use, *e.g.* ***a*** to prepare a solution for a titration experiment; ***b*** to prepare a metal surface for soldering by cleaning it with acid; ***c*** to prepare soil for germination experiments by sterilizing it with crude disinfectant. **2** To make a substance for a definite purpose, *e.g.* ***a*** to prepare Fehling's solution in order to test for the presence of reducing sugars; ***b*** to prepare pure copper (II) sulphate crystals to use in a copper voltameter. —***preparation*** (*n.*) ↑ DERIVE[1]

AJ020 produce[1] (*v.t.*) To make new substances by a chemical reaction or to make new substances, materials or objects by a process, *e.g.* ***a*** the reaction between zinc and hydrochloric acid produces hydrogen; ***b*** the Haber process produces ammonia; ***c*** a fertile soil produces heavy crops (fertile soil implies the possibility of many biochemical processes); ***d*** some species of birds only produce one egg for hatching (the bird is a combination of complex biological processes). Note the difference between **prepare** and **produce**: when copper (II) sulphate is prepared, the focus is on the method of making the substance, but when copper (II) sulphate is produced, the focus is on the result. —***product, production, productivity*** (*n.*) ↑ DERIVE[1] → PRODUCTIVITY

AJ021 form[4] (*v.t.*) To bring into existence, *e.g.* ***a*** when silver nitrate solution is added to sodium chloride solution a white precipitate is formed (the precipitate is brought into existence); ***b*** when an electric current is passed through a solenoid a magnetic flux is formed in the solenoid; ***c*** during metamorphosis of a pupa an imago is formed. ↑ DERIVE[1]

AJ022 maintain (*v.t.*) To cause to remain unchanged or undamaged, *e.g.* ***a*** to maintain a water-bath at a constant temperature (temperature remains unchanged); ***b*** to maintain a supply of electric current; ***c*** to

maintain apparatus, *i.e.* to keep the apparatus undamaged and functioning. —***maintenance*** (*n.*) ↑ DERIVE[1] → CONCERNED WITH · RESPONSIBLE FOR

AJ023 control (*v.t.*) To start, stop, increase and decrease a process, *e.g.* secretion by the adrenal medulla is controlled by the brain (the secretion can be started or stopped and the rate of secretion increased or decreased). Contrast **concerned with, responsible for,** and **control**: the nervous system of an animal is concerned with immediate adjustments to a changing environment, the muscles are usually responsible for this adjustment, and the brain controls the extent of the adjustment. —***control*** (*n.*) ↑ DERIVE[1]

AJ024 regulate (*v.t.*) To maintain a quantity at a required level, *e.g.* ***a*** to regulate the flow of water through a pipe (maintain a constant rate of flow); ***b*** specific hormones regulate the concentration of glucose in the blood at a level between narrow limits. Contrast **regulate, maintain** and **control**: a thermostat controls the quantity of electric current (starts, stops the current) passing through a heating coil, and then regulates the temperature of the water (quantity at required level) in a water bath, and the water bath is maintained at a constant temperature. —***regulation*** (*n.*) ↑ DERIVE[1]

AJ025 compensate (*v.t.*) To adjust a converse action or an effect, which maintains a process or a situation as it originally existed, *e.g.* ***a*** the balance wheel of a watch expands with a rising temperature but the circumference of the wheel consists of a bimetallic strip which curls with rising temperature and compensates for the expansion of the radius of the wheel, so that the wheel has the same period of rotation; ***b*** loss of sight is usually compensated by an improvement in hearing □ *a gap is left between railway lines to* compensate for *expansion* —***compensation*** (*n.*) ***compensatory*** (*adj.*) ↑ DERIVE[1]

AJ026 prevent (*v.t.*) To cause not to happen. In order to prevent an act or to prevent a process from taking place, an agent, animate or inanimate, must take action or be in action beforehand so that the act or process does not happen, *e.g.* ***a*** glass beads are placed in a flask to prevent bumping when a liquid boils (the beads are the agent placed beforehand and the process of bumping is not allowed to take place); ***b*** immunization of a person prevents the onset of a particular disease (antigens in the innoculation cause an increase in antibodies which does not allow the disease to develop); ***c*** accidents in the laboratory can be prevented by the proper training of students. Contrast **stop** and **prevent**: the man stopped the fight (the fight was taking place); the man prevented the fight (the fight did not start). —***prevention*** (*n.*) ***preventable, preventive*** (*adj.*) ↓ INHIBIT · OBSTRUCT · BLOCK · INTERFERE ↑ PROCESS[1] → FAVOUR (I)

AJ027 inhibit (*v.t.*) To slow down or to stop a process during its operation, *e.g.* ***a*** the presence of oxygen in a mixture of hydrogen and chlorine inhibits the formation of hydrogen chloride (the process is slowed down); ***b*** lack of nutrients in the soil inhibits the growth of plants (the growth is slowed down or stopped). Contrast **prevent** and **inhibit**: adverse conditions may prevent germination (process does not take place) and can inhibit growth (process slowed down). —***inhibitor*** (*n.*) ***inhibitory*** (*adj.*) ↑ PREVENT → ENCOURAGE (I)

AJ028 obstruct (*v.t.*) To prevent or to stop the free flow of a fluid in a channel, or of a stream of objects or particles, or of radiation (electromagnetic waves), *e.g.* ***a*** a clot of blood obstructs the free flow of blood in a blood vessel; ***b*** buildings obstruct radio waves of ultra-high frequency. The focus is on the flow. —***obstruction*** (*n.*) ***obstructive*** (*adj.*) ↑ PREVENT

AJ029 block (*v.t.*) To close a channel or passage and so prevent any object or fluid from passing through, *e.g.* ***a*** a clot of blood blocks an artery; ***b*** a capacitor blocks the passage of direct current. The focus is on the channel or passage-way. Contrast **block** and **obstruct**: if an artery is blocked no blood flows. There may be an obstruction in the artery which lessens the flow. The flow of blood is obstructed. ↑ PREVENT

AJ030 interfere (*v.i.*) To affect the normal course of a process so that the process is altered, slowed down, stopped, masked, or obscured, *e.g.* ***a*** the presence of nitrite ions interferes with the brown ring test for nitrate ions (the nitrite ion masks the presence of the nitrate ion and the result is obscure); ***b*** a cell infected by viruses produces a protein which interferes with glycolysis in the cell (the process of glycolysis is slowed down); ***c*** radio waves reflected from the upper atmosphere interfere with the ground wave and cause fading □ *impurities may* interfere with *the properties of a material* —INTERFERENCE (*n.*) ***interfering*** (*adj.*) ↑ PREVENT

AJ031 operative (*adj.*) Describes the cause of a particular effect, or the cause of a function being carried out, *e.g.* dilute acid catalyses the hydrolysis of esters, and the hydrogen ions are the operative agents, *i.e.* the hydrogen ions cause the acid to function as the catalyst. ↓ OPERATIONAL ↑ PROCESS[1]

AJ032 operational (*adj.*) Capable of performing its function, *e.g.* the chemical plant for the production of sulphuric acid is operational, *i.e.* it can carry out its function of making the acid – it can be put into operation. ↑ OPERATIVE

AJ033 simple (*adj.*) The term has various uses containing such ideas as: easy to understand; uncomplicated; not separated into parts; not possessing any smaller unit or division. Simple can be contrasted with **compound, complicated, complex**, or **intricate**, and the use varies according to collocation; the collocational uses will be

found under the main word, *e.g.* for *simple pendulum*, look up **pendulum**. ↓ COMPLEX (I) · COMPLICATED (Ag) · INTRICATE · STRAIGHTFORWARD · CRUDE ↑ PROCESS[1] → ELEMENTARY · PRIMITIVE

AJ034 complex (*adj.*) Describes a structure, system, or process, in which simpler parts are joined, or combined, in an orderly way to form a whole, *e.g.* ***a*** a protein has a complex molecule because the molecule is formed from the combination of simpler parts (different amino acids) which are arranged in a definite order. —***complexity, complex*** (*n.*) ***complex*** (*v.*) ↑ SIMPLE (I)

AJ035 complicated (*adj.*) Describes a state, situation or condition for which it may be difficult to understand the connection between the various parts; the various parts may all appear to be equally important, *e.g.* ***a*** the reaction between ethanol and concentrated sulphuric acid is a complicated process because it is difficult to understand how the reaction produces such products as ethanol, ethyl hydrogen sulphate, diethyl ether, carbon, and tar with only a slight variation in conditions; the two reactants appear to be of equal importance; ***b*** a complicated diagram (not a complex diagram) is one in which it is difficult to understand the connection between the various parts, which all appear equally important to an observer □ *the complicated nature of amino acids; the diagram of the roads in a big city forms a complicated pattern* —***complicate*** (*v.*) ***complication*** (*n.*) ↑ SIMPLE (Ag) → STRAIGHTFORWARD (Ag)

AJ036 intricate (*adj.*) Describes a process, sequence or configuration in which steps must be taken by an observer to carry out the process or to follow the sequence or the configuration, *e.g.* an intricate calculation is one in which a person must follow carefully a correct sequence of steps in order to obtain a correct result. Note the following difference: a **complicated** fracture has blood vessels and nerves as well as bones involved; an **intricate** surgical operation is needed to investigate a complicated fracture. Complicated describes the state of the fracture; intricate describes the process of investigation of the limb: a complicated problem (a state) but an intricate calculation (a process). —***intricacy*** (*n.*) ***intricately*** (*adv.*) ↑ SIMPLE

AJ037 straightforward (*adj.*) Describes a state of affairs, a situation or a condition when it is easy to understand the connection between the various parts, *e.g.* ***a*** the reaction between sodium chloride and silver nitrate in solution is a straightforward process as the reaction is easy to understand; ***b*** a straightforward diagram can be understood easily as the connection between the various parts can be seen without difficulty. To contrast **simple** and **straightforward**: a simple diagram has few parts or may not be separable into parts; a straightforward diagram can have many parts, but both types of diagram can be easily understood. ↑ SIMPLE (Sn) · COMPLICATED (Ag)

AJ038 crude (*adj.*) **1** Describes a chemical substance when mixed with impurities, *e.g.* ***a*** crude copper (II) sulphate is mixed with earth and other substances; ***b*** crude oil is obtained direct from deposits in the ground; it needs refining by distillation to obtain pure products. **2** Describes a device, instrument or apparatus which carries out a process, but a process that is unsatisfactory or wasteful, *e.g.* a compass in a coil of wire is a crude instrument for detecting electric current, as it is insensitive to small currents. —***crudity*** (*n.*) ↑ SIMPLE

AJ039 involved in (*adj.*) Describes that which is connected with a process. The term describes that which appears between the cause and the effect with no stated connection with either. It is only used predicatively, *e.g.* the vitamins are involved in a number of different types of reactions in the cells of the body (neither the cause nor the effect of the reaction is stated). —***involvement (in)*** (*n.*) ↓ CONCERNED WITH · RESPONSIBLE FOR ↑ PROCESS[1]

AJ040 concerned with (*adj.*) Describes that which is connected with the end point of a complex process, or a series of processes; the term implies that it is one of several factors and that it is more important than those which may only be involved in the process, *e.g.* ***a*** various hormones are produced by the placenta and are concerned with its maintenance during pregnancy (a complex process with other hormones involved in the process); ***b*** thermodynamics is concerned with the study of matter in the macroscopic state. ↑ INVOLVED IN

AJ041 responsible for (*adj.*) Describes an act, fact, condition or event which is the cause of, or leads to, a particular effect; the focus is on the agent, *e.g.* ***a*** in a mixture of sodium hydroxide solution and a fat, it is the hydroxyl ions which are responsible for hydrolysing the fat; ***b*** increasing the period of daylight by means of artificial light is responsible for an increase in the number of eggs laid by a hen. —***responsibility*** (*n.*) ↑ INVOLVED IN → CONTROL

AJ042 action[1] (*n.*) **1** The process of acting, *e.g.* if substance A acts on substance B, this is the action of A on B. **2** The way something acts, *e.g.* the action of the heart is the way in which the heart acts. **3** (Ph.) The effect of a force, *e.g.* ***a*** the action of a force at a point; ***b*** the action of a force on a body produces an equal and opposite reaction. ↓ FUNCTION[1] · CONDITION · FEEDBACK · EFFECT[1] · ACT · AFFECT · NECESSARY · POTENTIAL[1] · REPELLENT ↑ PROCESS[1]

AJ043 function[1] (*n.*) The way in which an object, or an artifact or part of an artifact, or part of an organism acts to carry out its purpose, *e.g.* ***a*** the function of a clutch in a motor car is to connect and disconnect, as needed, the engine from the gearbox; ***b*** the function of a galvanometer is to detect the flow of an electric current; ***c*** a function of the liver is to convert glucose to glycogen for

the storage of carbohydrate □ *when a muscle actually contracts, it is discharging its function* —***functional*** (*adj.*) ↓ AGENT · APPLICATION · ASSOCIATION[3] ↑ ACTION

AJ044 agent (*n.*) An element, compound, substance, or radiation, which can produce a named chemical or physical effect, *e.g.* ***a*** an oxidizing agent effects oxidation; ***b*** light is the agent producing photosynthesis. ↑ FUNCTION[1] → EFFECT

AJ045 accessory (*n.*) An object which aids or helps but is not necessary, *e.g.* ***a*** an adaptor is a useful accessory to a water condenser; ***b*** a set of shunts are useful accessories for converting a galvanometer to an ammeter. ↑ FUNCTION[1]

AJ046 application (*n.*) **1** The act of causing a force, potential, or field to act at a point or surface on a body, *e.g.* **a** the application of a force at a point; **b** the application of a high voltage to an electrode. **2** The act of coating or treating with a chemical, *e.g.* the application of a conducting layer to a glass screen. **3** The making use of a substance, effect, etc., *e.g.* the common pump is an application of atmospheric pressure (it makes use of atmospheric pressure in its action). ↑ FUNCTION[1]

AJ047 association[3] (*n.*) **1** (G.S.) The process of coming together for a common purpose, *e.g.* the students of English met to form a literary association. **2** (Ch.) The process by which two or more molecules join together. **3** The process of relating two concepts, *e.g.* the theory of electrode potentials is an association of the theory of the electrolytic cell and the theory of electrolysis □ *an* association between *two things*; *the* association of *one thing* with *another* ↑ FUNCTION[1] → DISSOCIATION (An) · COLLIGATIVE PROPERTIES

AJ048 condition (*n.*) Conditions are those items which make up the environment of an object, substance or organism and which may have an effect on a process in which the object, substance or organism is involved. Conditions may be **necessary** in which case the process will only begin and continue if the conditions are present. Conditions may be **adverse** in which case the process will not begin, or will stop because the conditions are present. Examples of conditions in chemistry are: the nature of the reactants, the temperature, the pressure, the intensity of light, the presence of the atmosphere, and the humidity of the atmosphere. Examples of conditions in biology are: temperature, light intensity, humidity, presence of air, and presence of nutrients. Examples of conditions: ***a*** the presence of oxygen (air) and water are necessary conditions for the rusting of iron; ***b*** a temperature above 50°C is an adverse condition for bacterial organisms. ↓ FACTOR · NECESSITY ↑ ACTION[1]

AJ049 factor (*n.*) A factor is one of a number of possible causes that can produce an effect or affect a change, *e.g.* ***a*** temperature, concentration, and presence of a catalyst, are three factors affecting the rate of a chemical reaction; ***b*** the length, the tension, and the mass per unit length, are three factors affecting the frequency of vibration of a stretched string; ***c*** a characteristic of an organism is controlled by a pair of character-producing factors. A factor may vary, as for example, raising the temperature of a reaction by 10°C normally doubles the rate of reaction. To contrast **factor** with **condition**: the presence of water is a necessary condition for the rusting of iron; the temperature of the surroundings is a factor affecting the rate of rusting. ↑ CONDITION

AJ050 necessity (*n.*) A cause, factor, condition or agent which is necessary for a process to take place, and without which it will not take place, *e.g.* oxygen is a necessity for the rusting of iron. ↓ NECESSARY ↑ CONDITION

AJ051 feedback (*n.*) The action by which the output of a process is coupled to the input. If an increase in the output causes a decrease in the input, the feedback is negative (as in a governor). If an increase in the output causes an increase in the input, the feedback is positive (as in an amplifier). *E.g.* a decrease in the concentration of carbon dioxide in the blood decreases the rate of respiration, and respiration itself decreases the concentration of carbon dioxide; this is positive feedback. The rate of respiration gradually falls to normal after the concentration of carbon dioxide has been temporarily increased by physical exercise. ↓ GOVERNOR ↑ ACTION[1]

AJ052 governor (*n.*) A device which uses negative feedback to maintain the speed of a machine or engine at a constant value. When the speed increases, the governor decreases the fuel supply (the input); when the speed decreases the governor increases the fuel supply. ↑ FEEDBACK

AJ053 effect[1] (*n.*) **1** An effect is an observable or a measurable change produced by a cause, *e.g.* ***a*** heat can have several effects on a substance – expansion, change of state, and decomposition; heat is the cause of these effects; ***b*** nitric acid has no effect on aluminium, *i.e.* there is no observable or measurable change; ***c*** a stimulus is a cause and a nervous impulse is the effect. **2** A specific phenomenon, named after its discoverer, *e.g.* the Bernouilli effect, named after Bernouilli, concerned with the fall in pressure (the effect) of a fluid flowing through a constriction (the cause) in a pipe. —***effect*** (*v.*) EFFECTIVE (*adj.*) ↓ CONSEQUENCE · ATTRACTION · REPULSION[1] · REPULSION[2] · REPELLANT ↑ ACTION[1]

AJ054 consequence (*n.*) An effect or result which follows on from a preceding cause, *e.g.* ***a*** the consequence of heating a given copper rod is that it undergoes oxidation (an effect) and forms an oxide (a result); ***b*** the consequence of heating a copper rod above its melting point is that it undergoes a change of state (an effect) and becomes a liquid (an effect) □ *the* consequence of *eating a poor diet is malnutrition* ↑ EFFECT[1]

AJ055 attraction (*n.*) **1** A physical process

in which two or more objects pull on each other, *i.e.* attract each other. The action is mutual, *e.g.* ***a*** a magnet attracts a piece of iron (the iron also exerts a force on the magnet); ***b*** the sun and the earth attract each other. **2** An action in which an organism is attracted by an object, *i.e.* it moves towards or tends to stay near the object, *e.g.* a moth is attracted by the scent of a flower. —ATTRACT (*v.*) ***attractive*** (*adj.*) ↓ REPULSION[1] (Cn) ↑ EFFECT[1]

AJ056 repulsion[1] (*n.*) The process that takes place when B repels A or when B and A mutually repel each other, *e.g.* when a positive electrode repels a positive ion a process of repulsion takes place between them. —***repulsive*** (*adj.*) ↑ EFFECT[1]

AJ057 repulsion[2] (*n.*) The act of B when B repulses A, *e.g.* when the human body repulses an attack by bacteria the body exhibits repulsion towards the attack. ↑ EFFECT[1]

AJ058 repellant (*n.*) Any object or substance which repels, *e.g.* the waxy cuticle of a leaf is a water repellant; ***b*** silicones are a class of substances which are water repellants. ↑ EFFECT[1]

AJ059 act (*v.i.*) To cause a chemical or physical change, or to have a physical effect □ *a force* acts at *a point; a force* acts in *a given direction; hydrochloric acid* acts on *magnesium metal* —ACTION, ACTIVITY, AGENT (*n.*) ACTIVE (*adj.*) ↓ ACT AS · APPLY · ASSOCIATE · ASSOCIATE WITH · DISPENSE WITH ↑ ACTION[1] → REACT · ACTIVATE

AJ060 act as (*v.i.*) To perform the function of something specified, *e.g.* carbon monoxide can act as a reducing agent. ↑ ACT · FUNCTION[1]

AJ061 apply (*v.t.*) **1** To cause a force, field or potential to act, *e.g.* ***a*** to apply a potential to an electrode; ***b*** a force of 10 newtons was applied at the point shown. **2** To treat with; to put on or to put into contact with, *e.g.* paint was applied to the surface of the door. **3** To make use of, *e.g.* physicists have applied the theory of relativity to the motion of particles. —APPLICATION (*n.*) ***applied*** (*adj.*) ↑ ACT

AJ062 associate (*v.i.*) **1** (G.S.) To come together for a common purpose. **2** (Ch.) Two or more like molecules associate when they join together to form a single molecule of a higher relative molecular mass. The action of association is readily reversible and depends only on the physical conditions, *e.g.* ethanoic acid molecules associate in solution in benzene. —ASSOCIATION (*n.*) ***associated*** (*adj.*) ↑ ACT → DISSOCIATE (An) · CONDENSE · POLYMERIZE · COMBINE

AJ063 associate with (*v.i.*) To relate one concept with another, *e.g.* to associate muscular action with movement. ↑ ACT → CONCEPT

AJ064 dispense with (*v.t.*) To use no longer an object which has been replaced by another object, *e.g.* the student dispensed with his alcohol burner when he was supplied with a gas burner. ↑ ACT

AJ065 affect (*v.t.*) To act upon an object, individual, or substance, and to cause a change, *e.g.* ***a*** lack of sunlight affects the growth of a plant; ***b*** the application of heat affects the rate of a chemical reaction; ***c*** the passage of an electric current through a resistor affects the temperature of the resistor. ↓ OBTAIN[2] · ATTRACT · REPEL · REPULSE · PREFER ↑ ACTION[1]

AJ066 obtain[2] (*v.t.*) To get possession of an object, process, radiation, or form of energy, when there is a purpose and an agent is used to do so; the agent is not necessarily named. *E.g.* ***a*** we obtain hydrogen from an acid, (using zinc as an agent for the reaction); ***b*** we obtain electrical energy from a primary cell; ***c*** the body obtains amino acids from protein, (using digestive enzymes as agents) □ *hydrogen is* obtained from *hydrochloric acid; hydrogen is* obtained by *the action of zinc on hydrochloric acid* ↑ AFFECT → ACQUIRE (Sn) · POSSESS

AJ067 attract (*v.t.*) **1** (Of an object) to pull an object towards itself, *e.g.* a magnet attracts a piece of iron (it pulls it with a force). **2** To cause to come towards itself, *e.g.* a light will attract insects. —ATTRACTION (*n.*) ***attractive*** (*adj.*) ↓ REPEL (Cn) · REPULSE (Cn) ↑ AFFECT

AJ068 repel (*v.t.*) **1** (Of an object) to cause to go away from itself, *e.g.* a positive electrode repels a positive charge (it pushes it with a force). If A and B mutually repel they both provide the stimulus and both go away from each other, *e.g.* like electric charges mutually repel each other. **2** To cause dislike, *e.g.* the smell of hydrogen sulphide repelled the boy (the boy moved away as though pushed by a force). —***repellant,*** REPELLENT (*n.,adj.*), REPULSION (*n.*) REPULSIVE (*adj.*) ↓ REPULSE (Sn) ↑ AFFECT

AJ069 repulse (*v.t.*) To cause to go away, *e.g.* the non-specific body defences repulse the attack of bacteria. If B repulses A then A provides the stimulus and B reacts to drive away A (the attack of bacteria provides the stimulus and the body reacts by driving away the attack, *i.e.* by repulsing the attack). —REPULSION (*n.*) REPULSIVE (*adj.*) ↑ AFFECT · REPEL (Sn)

AJ070 prefer (*v.t.*) (Of animals) to like a condition, type of food, or course of action, better than an alternative. To prefer a condition, etc., implies that the animal is capable of making a choice, and hence has a developed brain, *e.g.* ***a*** polar bears prefer living in a cold climate; ***b*** many monkeys prefer travelling from tree to tree to walking on the ground □ *a horse* prefers *eating short grass* to *eating long grass* —***preference*** (*n.*) ***preferred, preferable*** (*adj.*) ↑ AFFECT

AJ071 necessary (*adj.*) Describes a cause or agent, without which a process will not take place, *e.g.* oxygen is necessary for iron to rust; oxygen is an agent—it is necessary because without oxygen the process of rusting will not take place. Note the difference between **essential** and **necessary:**

essential describes a state, but necessary describes a process, *e.g.* an embryo is an essential part of a living seed (a state). The presence of water is necessary to the germination of the seed (a process) □ *water is* necessary to *the germination of a seed* (with nouns); *water is* necessary for *the seed to germinate* (with noun + action) ↓ UNNECESSARY (An) · PREFERENTIAL ↑ ACTION[1] → NEEDED (Sn) · REQUIRED (Sn) · ESSENTIAL · CONDITIONS

AJ072 unnecessary (*adj.*) Not necessary. Describes a cause or agent without which a process will still take place, *e.g.* the presence of nitrogen is unnecessary for iron to rust. ↑ NECESSARY (An)

AJ073 preferential (*adj.*) Describes one course of action out of several possible courses of action which is followed because of existing conditions, *e.g.* ***a*** the preferential discharge of hydrogen instead of sodium because of the lower electrode potential of hydrogen; ***b*** when the insulation on the wires in a domestic wiring system is damaged, a preferential circuit to earth may be formed and a short circuit then takes place. ↑ NECESSARY

AJ074 potential[1] (*adj.*) (G.S.) Having the power or ability to perform an action, or to develop a quantity or quality, with the power or ability present but not acting nor actual, *e.g.* ***a*** carbon monoxide from motor car exhausts is a potential danger to health, *i.e.* the danger is present but does not become actual until it is breathed in sufficient quantities; ***b*** sea water is a potential source of magnesium, *i.e.* the source is present but not yet developed as a source of a large quantity of magnesium. —***potentiality*** (*n.*) POTENT (*adj.*) ↓ DISPENSABLE · INDISPENSABLE · DISPOSABLE ↑ ACTION[1] → LATENT (Sn)

AJ075 dispensable (*adj.*) Describes an object which is or has become unnecessary for one's purpose, *e.g.* after supplying a laboratory with gas burners and a supply of gas, alcohol burners become dispensable. —DISPENSE WITH (*v.*) ↓ INDISPENSABLE (I) · DISPOSABLE (H) ↑ POTENTIAL[1]

AJ076 indispensable (*adj.*) Describes an object which is or has become necessary for one's purpose. The focus is on the fact that the loss of the object hinders a process, *e.g.* a clinical thermometer is indispensable for measuring a patient's temperature, *i.e.* it is almost impossible to measure the temperature accurately without a clinical thermometer. —***indispensability*** (*n.*) ↑ POTENTIAL[1] · DISPENSABLE (I)

AJ077 disposable (*adj.*) Describes a dispensable object which has only been used once and then is thrown away, *e.g.* a disposable syringe used once only to give an injection and then thrown away. ↑ POTENTIAL[1] · DISPENSABLE (H)

AJ078 repellent (*adj.*) Describes the nature of B when it repels A, *e.g.* the waxy cuticle of a leaf is repellent to water (the nature of the cuticle is repellent because it is waxy and so causes the water to go away). ↓ REPULSIVE[1] · REPULSIVE[2] ↑ ACTION[1]

AJ079 repulsive[1] (*adj.*) If one body repels another body a force of repulsion exists between them; this is a repulsive force. ↑ REPELLENT

AJ080 repulsive[2] (*adj.*) Describes the effect of B on A when B repulses A, *e.g.* the odour of some flowers is repulsive to some insects (the odour has the effect of repulsing the insect). ↑ REPELLENT

AJ081 use (*v.t.*) To cause to act for a particular purpose, *e.g.* ***a*** a man uses his legs for walking; ***b*** chlorine is used as a bleaching agent for cotton; ***c*** a simple pendulum is used to determine the acceleration due to gravity; ***d*** a scientist uses a thermometer to measure temperature (the scientist causes the thermometer to act as an instrument for measuring temperature). —***use*** (*n.*) ***useful, useless*** (*adj.*) ↓ INDUSTRY · EXPEND ↑ PROCESS[1]

AJ082 industry (*n.*) Large scale processes to make chemicals, materials or machinery. The chemical industry manufactures heavy chemicals, fine chemicals, pharmaceutical chemicals and other materials. The engineering industry manufactures motor cars, engines, ships, machinery and other mechanical objects. —***industrial*** (*adj.*) ↑ USE

AJ083 expend (*v.t.*) To use energy or materials for a definite purpose until the supply is usually, but not necessarily, finished, *e.g.* ***a*** the zinc case of a dry Leclanché cell is expended in providing an electric current (materials expended); ***b*** energy is expended in transporting ions across a membrane from a solution of low concentration to a solution of higher concentration. —***expense*** (*n.*) ***expendable*** (*adj.*) ↓ CONSUME[1] · DEPLETE · EXHAUST[2] · EXPLOIT ↑ USE

AJ084 consume[1] (*v.t.*) To use materials or energy so that they no longer exist in their original form, *e.g.* ***a*** a herbivorous animal consumes a large quantity of grass every day (the grass has been used as food and no longer exists as grass); ***b*** an electric iron consumes only a little electrical energy. Contrast **expend**: in expend, the focus is on the energy or material being used; in consume, the focus is on the object or organism using the energy or material, *e.g.* ***a*** an electric fire consumes 2 kW an hour (focus on the fire), but 5 kW an hour is expended in using an electric stove (focus on the electrical power used); ***b*** an elephant consumes a lot of grass as it expends a lot of energy moving from place to place. —***consumption*** (*n.*) CONSUMED (*adj.*) ↑ EXPEND → CONSUMED

AJ085 deplete (*v.t.*) To consume until only a little remains, *e.g.* ***a*** during a period of starvation, the fat reserve of an animal is depleted (very little fat remains); ***b*** growing too many crops on land depletes the available nitrates and other mineral salts in the soil. The focus is on the small quantity left after use. —***depletion*** (*n.*) ↑ EXPEND

AJ086 exhaust[2] (*v.t.*) To consume, or to remove, until nothing is left, *e.g.* when a

predator has eaten all its available prey, its food supply is exhausted. —***exhaustion*** (*n.*) ↑ EXPEND

AJ087 exploit (*v.t.*) To make maximum use of circumstances, or favourable conditions, when these occur, *e.g.* ***a*** xeromorphic plants, except succulents, exploit periods of favourable moisture conditions by photosynthesising, and therefore transpiring, rapidly; ***b*** people exploit the natural resources of a country (circumstances). —***exploitation*** (*n.*) ↑ EXPEND

AJ088 need[1] (*n.*) Any substance, radiation or condition that is necessary for a process to occur, *e.g.* water is a need of plants □ *needs are supplied; a plant* in need of *water* —NEED (*v.*) ↓ REQUIREMENT · NEED[2] · AVAILABLE[1] ↑ TIME → ENOUGH

AJ089 requirement (*n.*) Anything that is necessary or desirable for a process to occur, *e.g.* the requirements of a plant are air, water and mineral salts; they are also the needs of the plant. To contrast **need** and **requirement**— Need implies a permanent state, *i.e.* water is a continual need of a plant. Requirement implies an intermittent state, *e.g.* manuring is a requirement for strong plant growth, *i.e.* it is done intermittently. Plants require water when the soil is dry, *i.e.* not a permanent state □ *air is a requirement for plants; requirements are supplied* ↓ REQUISITE (Sn) · PREREQUISITE ↑ NEED[1] → NECESSITY

AJ090 requisite (*n.*) A required material object, *e.g.* potash is a requisite for strong plant growth. The distinction between **requisite** and **requirement** is not always made, and requirement is often used for both □ *both animal and vegetable proteins are requisites for a balanced diet* ↑ REQUIREMENT (Sn)

AJ091 prerequisite (*n.*) An object, substance or condition, that is required before a process can take place, *e.g.* moisture and warmth are two prerequisites for the germination of seeds. ↑ REQUIREMENT

AJ092 need[2] (*v.t.*) To be in a state in which some agent or cause must be supplied so that an important or vital process can continue, *e.g.* ***a*** the plant needs water or it will wither and die; ***b*** a diabetic patient needs insulin to maintain the glucose balance. —NEED (*n.*) ↓ REQUIRE (Sn) ↑ NEED[1]

AJ093 require (*v.t.*) To have the property or characteristic which will ensure that a potential process will take place, *e.g.* ***a*** plants require water to ensure that the transpiration flow takes place; ***b*** neutralization of an acid requires the correct amount of alkali; ***c*** a force of 3 kN is required to break the wire. Compare **need** and **require**; with need there must be an absence of some substance or condition which is necessary and the term is used frequently of vital processes. Require is used where there is a potential process, *e.g.* there is no need for a wire to break and a certain force is required to break it. —REQUIREMENT (*n.*) REQUISITE, ***prerequisite*** (*adj.*) ↑ NEED (*v.*) Sn

AJ094 available[1] (*adj.*) Describes material or energy that can be used as and when needed, *e.g.* ***a*** electrical energy is available from a simple cell; ***b*** plant nutrients are available in fertile soil. —***availability*** (*n.*) ↑ NEED[1]

Knowledge

AK001 knowledge (*n.*) The ability to make true statements and defend them as true. The statements include empirical generalisations, hypotheses and theories; the sum of knowledge is a collection of all statements whether arising from direct observation or as part of systematic truth. —***know*** (*v.*) ↓ NATURE[1]. · INVESTIGATE · EXPLORATORY · PERCEPT · WORD CLASS · → AFFIXATION · SCIENTIFIC WORD BUILDING · STATEMENT · OBSERVATION · EMPIRICAL GENERALIZATION · HYPOTHESIS · THEORY[1]

AK002 nature[1] (*n.*) The whole physical world including both living and non-living material, and radiation, but excluding objects made by men. Science is the explanation, in its own terms, of nature. —NATURAL (*adj.*) ↓ PHENOMENON · OBSERVATION ↑ KNOWLEDGE

AK003 phenomenon (*n., pl.* **phenomena**) Any property we have knowledge of, directly or indirectly, through our senses, *e.g.* magnetism, mass, atmospheric pressure, electricity and gravitation are all phenomena □ *we observe phenomena; natural phenomena* —***phenomenological*** (*adj.*) ↑ NATURE[1]

AK004 observation (*n.*) The intentional use of the senses, or the extended senses, for a special purpose, *e.g.* ***a*** when a seed is germinated, a student records observations on the events and the changes in form which take place; ***b*** when lead (II) nitrate is heated, a student makes observations on changes in colour and production of a gas with observable properties, such as colour, odour, action on litmus, action on a glowing splint; ***c*** when a solid is heated to its melting point, a student makes an observation of a change in state. —***observable*** (*adj.*) OBSERVE (*v.*) OBSERVER, OBSERVABLES (*n.*) ↑ NATURE[1] ↓ PERCEPT · PERCEIVE → READING · RESULT · RECORD · INFERENCE · TEST

AK005 investigate (*v.t.*) To make a careful study by means of observation, experimental tests and deductions from recorded facts, *e.g.* to investigate the properties of a magnet is to make observations on the

effect of the magnet on various objects, to record the facts, deduce the properties and test the properties to confirm them. ***—investigation, investigator*** (*n.*) ***investigating*** (*adj.*) ↓ EXPLORE · INQUIRE ↑ KNOWLEDGE

AK006 explore (*v.t.*) To use the senses or extended senses of sight and touch, or to use an instrument for obtaining and recording facts about an object, an organism, a property, a configuration, or a process, for the purpose of obtaining further knowledge about it, *e.g.* ***a*** to explore a wound with a probe to determine the extent and nature of it; ***b*** to use a search coil and galvanometer to explore a magnetic field. ***—exploration*** (*n.*) ***exploratory*** (*adj.*) ↑ INVESTIGATE

AK007 inquire (*v.i.*) To ask for information or to seek information from persons or records, *e.g.* to inquire into the possibility of building a nuclear power station. Also ***enquire***. ***—inquiry, inquirer*** (*n.*) ↑ INVESTIGATE

AK008 enquire (*v.t.*) A less frequent alternative for INQUIRE. ***—enquiry, enquirer*** (*n.*) ↑ INVESTIGATE

AK009 exploratory (*adj.*) Describes an object or process used for the purpose of exploring and obtaining information, *e.g.* an exploratory coil used to explore the distribution of intensity of a magnetic field. ↑ KNOWLEDGE

AK010 percept (*n.*) What is observed by the senses produces a sensation; the interpretation of the sensation by the mind is a percept, *e.g.* a baby sees a lot of marks on a newspaper (he sees only strange marks on the paper); a schoolboy not only sees the marks, but perceives the letters and words. ↓ CONCEPT · TERM · STATE OF AFFAIRS · PERCEIVE · OBSCURE[1] · PERCEPTIBLE[1] · OBSCURE[2] ↑ KNOWLEDGE

AK011 concept (*n.*) An idea or mental image in the mind when a person thinks of an object, property, configuration, collection, process or sequence. Simple concepts can be formed of objects which people can see or experience directly; when they have formed a concept they can recognize or represent the object, process, etc. For example, a horse is an object with certain properties (*e.g.* colour) and a configuration (shape). A person perceives these and is able to identify the object by isolating it from its surroundings. This permits the person to form a concept of the object in the mind. This concept permits him to recognise the object on another occasion and to represent it when it is not present so that he can think about it. This means he has a concept which he can discuss with other people by using the term 'horse'. Every person has a large collection of concepts, each with its own term, which permits him to discuss them with other people. By taking two or more concepts a person can abstract other concepts. For example, the concept of a quadruped can be abstracted from the concepts of horse, dog, cat, etc The abstraction of concepts can be illustrated by thinking about how we arrive at the concept of heat. The senses perceive something through feeling a sensation, seeing a change of state or colour, seeing an expansion, observing instruments or apparatus which extend the senses. Identification of these leads to the forming of simple concepts. From similar simple concepts, the concepts of expansion, conduction, convection, and radiation, are abstracted. Further abstractions from these concepts lead to the formation of concepts of temperature (a quality), quantity and transfer. The final abstraction is a concept of heat which permits recognition and representation of any of the concepts described above, together with their relationships. ↓ OBSERVABLES · DISPOSITION · THEORETICAL CONCEPT ↑ PERCEPT → IDENTIFY

AK012 observables (*n.pl.*) Concepts which have a direct link with perception, *i.e.* which can be observed by the senses or by the extended senses, as with telescopes, microscopes and other scientific instruments, *e.g.* the concept of a horse, a stone or a car are observables. ↑ CONCEPT

AK013 disposition (*n.*) A disposition is the concept of a property which is not open to observation at all times, *e.g.* the solubility of sugar is 203.9 g in 100 g of water at 20°C. This statement is true whether we are observing the solubility or not. Solubility is a disposition of sugar. Other examples of dispositions are: pathogenicity, infectivity, conductivity, recessivity, permeability, elasticity. ↑ CONCEPT

AK014 theoretical concept (*n.*) A concept which has no direct link with perception, *e.g.* the theoretical concept of the molecule; the theoretical term is the word 'molecule'. Other theoretical concepts are: the concept of photon, the concept of gene, the concept of a bond. ↑ CONCEPT

AK015 term (*n.*) A word or group of words used to represent a concept. The term relates the concept to the percept, and allows the members of a group with the same language to discuss the concept, *e.g.* the term 'horse' represents the same concept to all people in the same social group (those who use the English language). When a group consists of scientists, they will have a number of concepts of their own for which they will have special terms, or if they use terms from the common language they will give them more precise and limited definitions. In scientific language the following terms are used: observation terms, disposition terms and theoretical terms. ↓ OBSERVATION TERMS · DISPOSITION TERMS · THEORETICAL TERMS ↑ PERCEPT

AK016 observation terms (*n.pl.*) These are the terms (words) used for observables. They can also be described as terms which name percepts, *e.g.* cat (seeing); musical note (hearing); chlorine (seeing and smelling); sour (tasting). ↑ TERM

AK017 disposition terms (*n.pl.*) These are terms used for dispositions, *e.g.* soluble,

pathogenic, infective, conducting, recessive, permeable, elastic. They describe the property when it is observable. ↑ TERM

AK018 theoretical terms (*n.pl.*) These are the terms used for theoretical concepts, *e.g.* the words photon, molecule, electron. ↑ TERM

AK019 state of affairs (*n.*) A set of percepts in relation; it is the counterpart in perception of the sentence in language, *e.g. the cat sat on the grass* is a sentence; the event is the state of affairs which is perceived. ↓ OBSERVER · AUDIENCE ↑ PERCEPT

AK020 observer (*n.*) A person who observes. If an observation is objective, it does not depend on the thoughts or ideas of the observer and the same observation can be made and confirmed by any observer. If the observation is subjective, it will depend upon the observer. Scientific observations should always be objective. —***observation*** (*n.*) ***observe*** (*v.*) ↑ STATE OF AFFAIRS

AK021 audience (*n.*) A collection of people listening to a person or persons speaking or playing music, *e.g.* ***a*** the audience for a person speaking about the experimental evidence for sub-atomic particles; ***b*** an audience for a person playing the pianoforte. ↑ STATE OF AFFAIRS

AK022 perceive (*v.t.*) To be aware by the senses of an object, property, configuration, collection, process, sequence or event, through isolating the object, etc. from its surroundings, *e.g.* when a person sees, smells something, hears a sound, or touches something, then he is perceiving. —PERCEPT, ***perception*** (*n.*) ***perceptual,*** PERCEPTIBLE (*adj.*) ↓ OBSERVE · EXHIBIT · DISPLAY ↑ PERCEPT → SENSE · SENSATION

AK023 observe (*v.t.*) To perceive in a special way, concentrating on particular phenomena with a view to describing or understanding them, *e.g.* ***a*** a man sees a star as he sees a passing bird but when he observes a star, he isolates the star from the rest of his percepts, examines it carefully, and describes it and its motion accurately in the terms available in astronomy. —OBSERVATION (*n.*)↑ PERCEIVE

AK024 exhibit (*v.t.*) When a property, the concept of which is a disposition, is open to observation, the property is said to be exhibited, *e.g.* ***a*** when sugar is dissolved in water, its property of solubility, which is a disposition, is exhibited; ***b*** electrovalency is a disposition; when iron forms iron (II) sulphate it exhibits an electrovalency of 2; when iron forms iron (III) sulphate it exhibits an electrovalency of 3: iron can thus exhibit a variable electrovalency. —***exhibition*** (*n.*) ↓ DISPLAY (Sn) ↑ PERCEIVE

AK025 display (*v.t.*) To show an object or an action so that attention is drawn to it, or so that it is seen to the best advantage. *e.g* male weaver birds, when courting, display wing beating to attract a female bird's attention. —***display*** (*n.*) ↑ PERCEIVE · EXHIBIT (Sn) → EXPOSE

AK026 obscure[1] (*v.t.*) To make difficult to see clearly or fully; the term is applied to objects, ideas and statements, *e.g.* ***a*** in a solar eclipse the moon obscures the sun; ***b*** if the errors in the readings recorded in an experiment are large any relation between the variables is obscured. —OBSCURE (*adj.*) ↓ MASK · SUPPRESS · REVEAL ↑ PERCEPT → CLARIFY (Ag)

AK027 mask (*v.t.*) To prevent from being seen; the term is used when one effect is not seen because of a stronger, overlying effect, *e.g.* ***a*** the yellow coloration of a flame by a sodium compound would mask the lilac coloration of the potassium flame; ***b*** the effect of a fungal organism on a plant can mask the effect of a second parasite. ↑ OBSCURE

AK028 suppress[1] (*v.t.*) To prevent an action or a process from starting or continuing, *e.g.* ***a*** a capacitor is connected in parallel with the contacts of a make-and-break circuit to suppress sparking when the circuit is broken; ***b*** a suppressor is connected to an electric motor to suppress interference to radio reception; ***c*** if sodium ethanoate is added to ethanoic acid, the ethanoate ions from the sodium ethanoate suppress the ionization of the ethanoic acid. —***suppressor*** (*n.*) ***suppressive*** (*adj.*) ↑ OBSCURE[1] ↓ REVEAL (An) → SUPPRESS[2]

AK029 reveal (*v.t.*) To allow or to cause to be seen, by the removal of a barrier or obstacle, a percept, idea, or thought, which was previously hidden, *e.g.* ***a*** when a bud unfolds it reveals the stigma and stamens previously hidden within the petals; ***b*** a study of radioactivity revealed previously unknown facts about the structure of the atom. ↑ OBSCURE[1] · SUPPRESS[1] (An)

AK030 perceptible[1] (*adj.*) Able to be perceived, and hence able to be isolated from a similar object, *e.g.* a colour change can be perceived, *i.e.* the colour change is perceptible. ↑ PERCEPT

AK031 obscure[2] (*adj.*) Describes objects, concepts, propositions, and other terms or statements which are difficult to see or understand, *e.g.* ***a*** an obscure term is one which is rarely used and not often understood (the defect is lack of use); ***b*** an obscure relation exists between air pollution and some types of mental illness (difficult to see and not readily understood). ↓ CLEAR[2] (Ag) ↑ PERCEPT → DISTINCT (Ag) · EVIDENT (Ag)

AK032 clear[2] (*adj.*) Describes an object that can be seen with ease, or a statement, principle, or theory, that can be easily understood, *e.g.* ***a*** a clear image of the moon was formed on the screen by the lens; ***b*** the definition of an ideal gas is quite clear as long as the Kinetic Theory of Gases is understood. —***clarity*** (*n.*) ↑ OBSCURE[2] (An) → CLARIFY · CLEAR[1]

AK033 word class (*n.*) A set of words which display the same function in a sentence. The important word classes in English are noun, pronoun, verb, adjective, adverb, preposition, and article. These classes are also

called ***parts of speech.*** ↓ ABBREVIATION · FOCUS ↑ KNOWLEDGE

AK034 abbreviation (*n.*) A well-known word or group of words shortened to one or a few letters; sometimes these are Latin expressions. The common abbreviations used in this book are listed in Appendix 3. ↓ STAND FOR ↑ WORD CLASS

AK035 stand for (*v.t.*) To represent by a symbol or letter, *e.g.* ***a*** the letter *I* stands for electric current in scientific formulae; ***b*** an abbreviation stands for a word or group of words; ***c*** the symbol × stands for multiplication. ↑ ABBREVIATION

AK036 focus[1] (*n.*) The direction of a person's attention to a particular part of a process, or to a state of affairs. In a process there is generally an agent carrying out the process, and a recipient on whom the process operates. Focus can direct attention to the agent, or the recipient, or the process, *e.g.* the flow of water in a pipe can be stopped by an object in the pipe. The focus is on the flow of water when the term **obstruct** is used, and on the pipe when the term **block** is used, *e.g.* ***the flow of water is obstructed*** directs attention to the stopping of the flow of water. Saying that ***the pipe is blocked*** directs attention to the object blocking the pipe and there need not be any flow through the pipe to be stopped. ↑ WORD CLASS

Word Analysis

AL001 affixation (*n.*) A process in which new words are formed by adding groups of letters (affixes) to a shorter word or base. The affixes can be placed at the beginning of the base or at the end, *e.g.*

noun	friend
noun → adjective	(friend)-ly
adjective → adjective	un-(friend)-ly
adjective → noun	un-(friend-li)-ness

—***affix*** (*n.*) ***affix*** (*v.*) ↓ PREFIX · SUFFIX · HYPO- · TRANS- · ORTHO- · RETRO · CIRCUM- · MONO- · UNI- · HAPLO- · HETERO- · CHRON- · AUTO · CHROM- · DYS- · AER- · PHOTO- · -IVE · -OSE · -IVOROUS · -ESCENCE · -GRAM → KNOWLEDGE

AL002 prefix (*n.*) If the affix is added to the beginning of the word it is called a prefix, *e.g.* active → inactive (the reverse of active). ↑ AFFIXATION

AL003 suffix (*n.*) If the affix is added to the end of the word it is called a suffix, *e.g.* reverse (*v.*) → reversible (*adj.*) ↑ AFFIXATION

AL004 hypo- (*pre.*) Under; lower in position; less in quantity or effect, *e.g.* *hypo*pharyngeal, under the pharynx (position); *hypo*gynous, receptacle under the ovary (position); *hypo*tonic, has a lower osmotic pressure (measurement or quantity); *hypo*function, functions less actively than normal (produces lesser effect). The term is contrasted in position, quantity or effect by *hyper-*, *e.g.* hyperpharyngeal, hypertonic, hyperfunction. It is contrasted in position by *epi-*, *e.g.* epigynous. With quantities, both *hypo-* and *hyper-* are contrasted with *iso-*, *e.g.* isotonic. ↓ HYPER- (Cn) · ISO- (An) · EPI- (Cn) · SUB- (Sn) · SUPRA- · SUPER- ↑ AFFIXATION

AL005 hyper- (*pre.*) Over; higher in position; more in quantity or effect, *e.g.* *hyper*pharyngeal, above or ventral to the pharynx (position); *hyper*tonic, has a higher osmotic pressure (measurement or quantity); *hyper*function, functions more actively than normal (produces greater effect); *hyper*parasite, a parasitic animal which is itself a parasite on a parasite. The term is contrasted with *hypo,* *e.g.* hypopharyngeal, hypotonic, hypofunction, and with *iso-*, *e.g.* isotonic. ↓ SUPRA- (Sn) · SUPER- (Sn) · ISO- (An) ↑ HYPO- (Cn)

AL006 iso- (*pre.*) Equal in quantity or measurement; identical in structure, *e.g.* *iso*tonic, has an equal osmotic pressure (quantity); *iso*dont, having teeth all identical, *i.e.* identical structure and size; *iso*morphic, having an identical structure. The term is contrasted for quantity by *hyper-* and *hypo-*, and for structure with *hetero-* and *homo-*, *e.g.* heterodont and homodont. ↑ HYPO- (An) · HYPER- (An) → HOMO- (Sn)

AL007 epi- (*pre.*) Upon, or on the surface of, *e.g.* *epi*gynous, receptacle above or upon the ovary (position); *epi*phyte, plant that grows on the surface of another plant. ↑ HYPO- (Cn)

AL008 sub- (*pre.*) Beneath in position, or smaller in structure, importance or degree, *e.g.* *sub*clavian, underneath the clavicle (position); *sub*dermal, beneath the dermis (position); *sub*atomic, smaller in structure than atomic; *sub*species, a division of species (degree in taxonomy); *sub*acuminate, somewhat tapering (less in degree than tapering); *sub*sonic, less than the speed of sound. To contrast *hypo-* and *sub-* in hypodermal and subdermal: hypodermal is derived from hypodermis, an underlayer of the dermis; subdermal is derived from sub- and dermis and describes a region below the hypodermis. ↓ SUPRA- (Cn) · SUPER- (Cn) ↑ HYPO- (Sn)

AL009 supra- (*pre.*) Above (mainly used in anatomical terms), *e.g.* *supra*clavicular, above the clavicle; *supra*renal, above the kidney. ↓ SUPER- (Sn) ↑ HYPO- · HYPER- (Sn) · SUB- (Cn)

AL010 super- (*pre.*) Greater in quantity or quality, especially in relation to a given standard or measure, or greater in effect; also above in position, similar to supra-, *e.g.* *super*cooled, cooled below the normal temperature for liquefaction or solidification (greater cooling); *super*sonic, greater than the speed of sound; *super*glottis, above the glotis. The term is contrasted with *sub-*, *e.g.* supersonic, subsonic. ↑ HYPO- · HYPER- (Sn) · SUB- (Cn)

AL011 trans- (*pre.*) Across; on the side of, *e.g.* *trans*median, across the middle plane; *trans*fusion, passing a liquid from one place to another; *trans*arrangement, two mutations carried on different chromosomes of a pair of chromosomes. ↓ CIS- (Cn) · PARA- · AMPHI- · AB- · AD- · LONGI- · PER- · DIA- ↑ AFFIXATION

AL012 cis- (*pre.*) On the same side as, *e.g.* *cis*arrangement, two mutations carried on one chromosome of a pair. ↑ TRANS- (Cn)

AL013 para- (*pre.*) By, or at the side of, *e.g.* *para*mastoid, at the side of the mastoid; *para*nucleus, a micronucleus at the side of a nucleus; *para*physis, a side-shoot, or outgrowth; *para*vertebral, alongside the vertebral column. ↑ TRANS-

AL014 amphi- (*pre.*) On both sides, *e.g.* *amphi*genous, growing on both sides of a structure, such as a leaf; *amphi*stomatic, having stomata on both surfaces of a leaf; *amphi*trichous, having flagella at both ends. ↑ TRANS-

AL015 ab- (*pre.*) Away from; on the opposite side of, *e.g.* *ab*terminal, from the end inwards; *ab*oral, on the opposite side from the mouth. ↓ AD- (Cn) ↑ TRANS-

AL016 ad- (*pre.*) To or on the side of, *e.g.* *ad*medial, towards the middle; *ad*rectal, near to the rectum; *ad*oral, on the same side as the mouth. ↑ TRANS- · AB- (Cn)

AL017 longi- (*pre.*) Along; lengthwise; long, *e.g.* *longi*rostral, having a long beak; *longi*tudinal, along the axis of a body; *longi*corn, possessing long antennae (of insects). ↑ TRANS- (An)

AL018 per- (*pre.*) Through, *e.g.* *per*foliate, through a leaf, as of stems; *per*ennial, living through a season, or through a number of years; also in verbs such as: *per*colate, *per*forate, *per*spire. ↓ DIA- (Sn) ↑ TRANS-

AL019 dia- (*pre.*) Across or through, *e.g.* *dia*phragm, a partition across a body; *dia*meter, a straight line across the centre of a circle; *dia*thermy, the passing of heat through a body. ↑ TRANS- · PER- (Sn)

AL020 ortho- (*pre.*) Straight; upright; at right angles, *e.g.* *ortho*blastic, possessing a straight germ band; *ortho*genesis, evolution in a fixed direction; *ortho*tropic, growing vertically upwards, *ortho*gonal, at right angles. ↓ ANKYLO- (Cn) · PLAGIO- (Cn) · CATA- · APO- · TELE- · ULTRA- · INFRA- ↑ AFFIXATION

AL021 ankylo-, anchylo- (*pre.*) Bent or crooked, *e.g.* *ankylo*blastic, possessing a crooked germ band; *ankyroid*, hook-shaped ↑ ORTHO- (An)

AL022 plagio- (*pre.*) Oblique, *e.g.* *plagio*tropous, growing at an oblique angle. ↑ ORTHO- (An)

AL023 cata-, kata- (*pre.*) Down; against, *e.g.* *cata*petalous, having petals united with the base of stamens; *cata*dromous, growing downwards; *cata*ract, a waterfall; *cata*bolism, breaking down. ↑ ORTHO-

AL024 apo- (*pre.*) Away from, and thus without, *e.g.* *apo*typic, diverging away from a typical specimen of an organism; *apo*physis, an outgrowth away from a main structure; *apo*sporogony, away from sporogony, *i.e.* sporogony is absent; *apo*gamy, sexual reproduction without the aid of sexual organs. ↑ ORTHO- → A- (Sn)

AL025 tele- (*pre.*) Far away; at a distance, *e.g.* *tele*receptor, a sense organ receiving stimuli from a distance; *tele*scope, a device for viewing distant objects. ↑ ORTHO-

AL026 ultra- (*pre.*) Beyond, *e.g.* *ultra*violet, beyond the visible (violet) wavelengths of electromagnetic waves; *ultra*microscope, a device which permits objects to be seen which are too small to be seen by an ordinary microscope. ↓ INFRA- (An) ↑ ORTHO-

AL027 infra- (*pre.*) Below, *e.g.* *infra*branchial, below the gills; *infra*costal, below the ribs; *infra*red, below the visible (red) wavelengths of electromagnetic waves. ↑ ORTHO- · ULTRA- (An)

AL028 retro- (*pre.*) Backwards; behind, *e.g.* *retro*curved, bent backwards; *retro*gressive, moving backwards in development, *i.e.* degenerating; *retro*pharyngeal, behind the pharynx. ↓ COUNTER- · SYN- · CO- · COENO- · PAN- · A- · RE- (Sn) ↑ AFFIXATION → PRO- (Cn)

AL029 counter- (*pre.*) Acting or moving against, or moving in the opposite direction, *e.g.* *counter*poise, a weight acting against another weight, to balance it; *counter*irritation, the use of an irritant to draw blood away from an inflammation; *counter*clockwise, in the opposite direction to clockwise. ↑ RETRO- · ANTI- (Sn)

AL030 syn-, sym- (*pre.*) Joined or together in time or space, *e.g.* *syn*apse, the structure joining two nerves; *syn*chronous, at the same time, together in time; *syn*ergic, working together; *sym*physis, a growing together of two bones; *sym*biosis, living together, for mutual benefit, of two organisms. ↓ CO- (Sn) · COENO- (Sn) ↑ RETRO-

AL031 co- (*pre.*) Sharing in common; acting together, *e.g.* *co*enzyme, a substance which acts together with an enzyme; *co*action, the reciprocal action of an organism on a community; *co*dominant, one of two equally dominant genes, acting together in an individual. Also found in verbs such as: *co*alesce, *co*agulate, *co*here, *co*incide. ↓ COENO- ↑ SYN- (Sn) · RETRO-

AL032 coeno- (*pre.*) Sharing in common, *e.g.* *coeno*blast, a germ-layer from which both endoderm and mesoderm develop; *coeno*site, an organism habitually sharing food with another organism; *coeno*gamete, a multi-nuclear gamete (the nuclei share the gamete in common). ↑ RETRO-

AL033 pan- (*pre.*) All; every; completely, *e.g. pan*chromatic, reacts to light of all colours, *pan*demic (of disease) attacks people over a wide area, usually world-wide. ↑ RETRO-

AL034 a- (*pre.*) Without, *e.g. a*phyllous, state of being without leaves; *a*chromatic, being without colour; *a*crania, being without part or all of the skull at birth. ↑ RETRO-

AL035 re- (*pre.*) Again; repeat, *e.g. re*distillation, to distil a second time; *re*current, to occur again and again; *re*generate, to give back, or to make again, a substance, or a form of energy. ↑ RETRO- (Sn)

AL036 circum- (*pre.*) Going round, or around; around about a structure, *e.g. circum*ferential, describes cartilage surrounding a bony fossa; *circum*vallation, encircling by tissues, as of amoeboid organisms in engulfing; *circum*polar, describes organisms found in polar regions, *i.e.* about the Poles. ↓ PERI- (Sn) · ECTO- · ENDO- · EXO- · MESO- ↑ AFFIXATION

AL037 peri- (*pre.*) Going around a structure, *e.g. peri*mysium connective tissue enclosing fibres to form muscles; *peri*chondrium, a fibrous membrane enclosing cartilage; *peri*gonium, a ring of leaves round the base of an archegonium. ↑ CIRCUM- (Sn)

AL038 ecto- (*pre.*) Outer or outside structure, *e.g. ecto*derm, the outer layer of a diploblastic, or triploblastic, animal; *ecto*parasite, a parasite living on the exterior, or outside surface, of a host; *ecto*phloic, with phloem outside the xylem. Contrast *epi-*, meaning on: *epi*phyte (a plant living on other plants for support); *ecto*phyte (plant parasite living outside plants or animals). ↓ ENDO- (Cn) · EXO- (Sn) · MESO- (An) ↑ CIRCUM-

AL039 endo- (*pre.*) Inner, or inside structure; inwards, *e.g. endo*derm, the inner layer of a diploblastic or triploblastic animal; *endo*parasite, a parasite living inside a host; *endo*smosis, diffusion inwards through a semi-permeable membrane; *endo*thermic, taking heat in. ↓ EXO- (Cn) · MESO- (An) ↑ ECTO- (Cn) · CIRCUM-

AL040 exo- (*pre.*) Outwards, *e.g. exo*derm, the outer layer of sponges; *exo*parasite, an ectoparasite; *exo*smosis, diffusion outwards through a semi-permeable membrane; *exo*phytic, of or to do with the exterior or outside surface of plants; *exo*thermic, giving heat out. ↑ CIRCUM- · ENDO- (Cn) · ECTO- (Sn)

AL041 meso- (*pre.*) In the middle of a structure; intermediate in place, quality or quantity, *e.g. meso*derm, the middle layer of a triploblastic animal; *meso*branchial, the middle region of a gill; *meso*morphic, having an intermediate structure between extremes; *meso*pelagic, inhabiting an intermediate ocean depth (between 200 and 1000 metres); *meso*n, an elementary particle, intermediate in mass between an electron and a proton. ↑ CIRCUM- · ECTO- (An) · ENDO- (An)

AL042 mono- (*pre.*) One; single, *e.g. mono*dactylous, having only one digit or claw; *mono*chromatic, being composed of only one colour; *mono*mer, a simple molecule of a substance, capable of combining with itself to form polymers; *mona*delphous, having the stamens united to form a tube. (Note: if the basic term begins with a vowel, the prefix is **mon-**). The prefix **mono-** is derived from the Greek word for *one*; there are corresponding prefixes for the Greek words, *two, three, many*, etc., given in the group of words below. If a term can be prefixed by several number indicators, then these should all be derived from the same language, and are taken from the group below. The biological sciences almost always use the Greek number derivatives; the physical sciences mainly use Greek number derivatives, but occasionally use Latin number derivatives. ↓ DI- · TRI- · TETRA- · PENTA- · HEXA- · OCTO- · DECA- · HEMI- ↑ AFFIXATION

AL043 di- (*pre.*) Two; twice, *e.g. di*chromatic, being composed of two colours; *di*mer, a substance with molecules formed from two simpler molecules; *di*oecious, describes animal species with separate males and females, and plants with male and female flowers on separate plants; *di*adelphous, stamens in two groups, formed by the joining of their stems. ↑ MONO-

AL044 tri- (*pre.*) Three; threefold, *e.g. tri*chromatic, being composed of three colours; *tri*mer, a substance with molecules formed from three simpler molecules; *tri*oecious, a plant with male, female, and hermaphrodite flowers on separate plants; *tri*adelphous, with stamens united by their filaments into three bundles. ↑ MONO-

AL045 tetra- (*pre.*) Four, *e.g. tetra*dactylous, having four digits on an appendage; *tetra*ndrous, having four stamens; *tetra*morphic, having four different forms; *tetro*de, a thermionic valve with four electrodes. ↑ MONO-

AL046 penta- (*pre.*) Five, *e.g. penta*dactylous, having five digits on an appendage; *penta*delphous, having stamens united into five clusters of united filaments; *penta*ndrous, having five stamens; *pento*de, a thermionic valve with five electrodes. ↑ MONO-

AL047 hexa- (*pre.*) Six, *e.g. hexa*gynous, having six pistils; *hexa*pod, having six legs; *hexa*merous, arranged in sixes, or occurring in sixes; *hexa*hydrate, hydrate with six molecules of water of crystallization combined with one molecule of the substance; *hexo*de, a thermionic valve with six electrodes. ↑ MONO-

AL048 octo- (*pre.*) Eight, *e.g. octo*gynous, having eight pistils; *octa*ndrous, having eight stamens; *octo*pod, having eight legs; *octe*t, a group of eight electrons which fill an outer valency shell; *octo*de, a thermionic valve with eight electrodes. ↑ MONO-

AL049 deca-, deka- (*pre.*) Ten, *e.g. deca*ndrous, having ten stamens; *deca*merous, with parts arranged in tens;

*deca*pod (of crustaceans) with five pairs of legs. ↑ MONO-

AL050 hemi- (*pre.*) A half, *e.g. hemi*sphere, half a sphere; *hemi*metamorphosis, incomplete metamorphosis in which the pupal stage is omitted; *hemi*hydrate, a hydrate in which two molecules of the substance share one molecule of water of crystallization; *hemi*some, a symmetrical half of an animal about a median vertical plane. ↑ MONO-

AL051 uni- (*pre.*) One; single, *e.g. uni*nucleate, having one nucleus; *uni*lateral, arranged on one side only; *uni*cellular, consisting of only one cell; *uni*variant, having only one degree of freedom. The prefix **uni-** is derived from the Latin word for one. The corresponding prefixes for the Latin words, two, three, etc. are given in the group below. ↓ BI- · TER- · QUADRI- · QUIN- · DEC- · CENT- · MILLI- · SEMI- ↑ AFFIXATION

AL052 bi- (*pre.*) Two; twice, *e.g. bi*nuclear, having two nuclei; *bi*cellular, composed of two cells; *bi*variant, having two degrees of freedom; *bi*lateral, having two sides symmetrical about an axis. ↑ UNI-

AL053 ter- (*pre.*) Three; third, *e.g. ter*tiary, third in order of development, such as tertiary roots developed from secondary roots; *ter*nary, arranged in threes. ↑ UNI-

AL054 quadri- (*pre.*) Four; square; at right angles, *e.g. quadri*fid, deeply cleft into four parts; *quadru*ped, animal with four legs; *quadra*t, a small square or rectangular area selected for biological observations. ↑ UNI-

AL055 quin- (*pre.*) Five, *e.g. quin*ate, five leaflets growing from one point; *quin*quefid, deeply cleft into five parts; *quin*tuplet, a group of five similar or identical objects. ↑ UNI-

AL056 dec- (*pre.*) Ten; tenth, *e.g. dec*emfid, cleft into ten segments; *dec*ade, a group of ten, particularly ten years; *deca*pod, an animal with ten legs; *dec*imolar, with one tenth of a mole; *dec*imal, a system of tenths. ↑ UNI-

AL057 cent- (*pre.*) One hundred; a hundredth, *e.g. cent*ury, a hundred years; *centi*metre, a hundredth of a metre; *centi*pede, an arthropod with many feet, but not as many as a millipede. ↑ UNI-

AL058 milli- (*pre.*) A thousand; a thousandth, *e.g. milli*metre, one thousandth of a metre; *mill*enium, thousand years; *milli*pede, arthropod with numerous legs. ↑ UNI-

AL059 semi- (*pre.*) Half, but also means partly, or with restrictions, *e.g. semi*lunar, half-moon shaped; *semi*oviparous, between oviparous and viviparous, as a marsupial whose young are not fully developed when born; *semi*conductor, a material with a high electrical resistance at normal temperatures, but a low resistance at high temperatures, *i.e.* between a conductor and an insulator; *semi*permeable, permeable to water and other solvents, but impermeable to solutes. ↑ UNI-

AL060 haplo- (*pre.*) Simple; single, *e.g. haplo*caulescent, having a simple axis *i.e.* capable of producing seed on the main axis; *haplo*dont, having molars with simple crowns (no cusps); *haplo*petalous, having a single row of petals; *haplo*stemonous, having one whorl of stamens; *haploid*, the typical number of chromosomes in a germ-cell. ↓ DIPLO- · DUPLI- · TRIPLO- · OLIGO- · OMNI- · POLY- · MULTI- · MYRIA- ↑ AFFIXATION

AL061 diplo- (*pre.*) Double, *e.g. diplo*caulescent, having secondary stems; *diplo*stemonous, with stamens in two whorls; *diploid*, having a double set of chromosomes, as in somatic cells; *diplo*blastic, having two distinct germ-layers. ↑ HAPLO-

AL062 dupli- (*pre.*) Double, *e.g. dupli*city, condition of being two-fold, as in cones and rods for vision; *dup*let, a pair of electrons; *dupli*cate, to make double the number. ↑ HAPLO-

AL063 triplo- (*pre.*) Threefold, *e.g. triplo*stichous, arranged in three rows; *triploid*, with three times the number of haploid chromosomes; *triplo*blastic, having three distinct germ-layers. ↑ HAPLO-

AL064 oligo- (*pre.*) A few; little, *e.g. oligo*stemonous, having few stamens; *oligo*rhizous, having few roots; *oligo*androus, having few stamens; *oligo*carpous, having few carpels; *oligo*trophic, providing little, or inadequate, nourishment. ↑ HAPLO-

AL065 omni- (*pre.*) All, *e.g. omni*vorous, eating animal and plant tissues; *omni*colous, capable of growing on different substrata; *omni*genous, composed of all types. ↑ HAPLO-

AL066 poly- (*pre.*) Many, *e.g. poly*dactyl, having more than five digits or more digits than normal; *poly*pod, having many feet; *poly*adelphous, having stamens united by their filaments into three or more groups; *poly*androus, having twenty or more stamens; *poly*chromatic, having a number of colours; *poly*mer, a substance with a molecule formed from many simpler molecules by polymerizing; *poly*gon, a plane figure with a number of straight sides. ↑ HAPLO-

AL067 multi- (*pre.*) Many, *e.g. multi*cauline, with many stems; *multi*nucleate, with several, or many, nuclei (alternative for polykaric); *multi*foliate, with many leaflets; *multi*lobulate, having many lobes. ↑ HAPLO-

AL068 myria- (*pre.*) Many; innumerable, *e.g. myria*poda, arthropods with numerous legs, including centipedes and millipedes; *myriophylloid*, having a much-divided thallus. ↑ HAPLO-

AL069 hetero- (*pre.*) Other; different, *e.g. hetero*karyotic, having genetically dissimilar nuclei in a multinucleate cell; *hetero*morphic, having a number of different forms, *hetero*gamete, one of dissimilar conjugating gametes ↓ HOMO- (Cn) · HOLO- · MER- · MACRO- · MEGA- · MICRO- ↑ AFFIXATION

AL070 homo- (*pre.*) The same; alike, *e.g. homo*morphic, of similar size and structure; *homo*gamete, gametes of one type only,

*homo*dont, having teeth which are all alike. ↑ HETERO- (Cn) → ISO- (Sn)

AL071 holo- (*pre.*) Complete; whole, *e.g. holo*phytic, obtaining the whole of its food in the manner of a green plant; *holo*metabola, (in insects) undergoing complete metamorphosis; *holo*parasite, a parasite which cannot exist without a host, *i.e.* completely, or wholly, parasitic. ↓ MER- (An) ↑ HETERO- → HEMI- (An)

AL072 mer- (*pre.*) A part, *e.g. mero*blastic, ova undergoing partial cleavage; *mero*me, a body segment; *mero*zygote, a zygote containing only part of the genome of one of the two uniting gametes. ↑ HETERO-

AL073 macro- (*pre.*) Great; large, *e.g. macro*gamete, the larger of two conjugating gametes; *macro*scopic, large enough to be seen by the eye; *macro*stomatous, with a very large mouth. ↓ MEGA- (Sn) · MICRO- (Cn) ↑ HETERO-

AL074 mega- (*pre.*) Great; larger than normal, *e.g. mega*gamete, alternative term for macrogamete; *mega*loblast, a large erythroblast; *mega*karyocyte, an amoeboid giant cell, with a large lobed nucleus. ↓ MICRO- (Cn) ↑ HETERO · MACRO- (Sn)

AL075 micro- (*pre.*) Small, especially too small to be seen by the naked eye, *e.g. micro*blast, an erythroblast smaller than usual; *micro*gamete, the smaller of two conjugating gametes; *micro*scopic, too small to be seen without a microscope; *micro*stome, a small mouth or opening. ↑ MEGA- (Cn) · MACRO- (Cn) · HETERO-

AL076 chron- (*pre.*) Time, *e.g. chron*ology, the study of time measurement; *chron*ic, describes a disease lasting a long time; *chrono*tropic, affecting the rate of action, *i.e.* by changing the time. ↓ ARCHE- · PROTO- · PRO- · POST- · ANTE · PRE · META- ↑ AFFIXATION

AL077 arche- (*pre.*) First; earliest; beginning; primitive (and hence chief in some words), *e.g. arche*ncephalon, the primitive fore-brain or cerebrum; *arche*nteron, the cavity of a gastrula, which develops into the primitive gut of the embryo; *arche*type (also *archi*type), an original type from which other types have developed. ↑ CHRON-

AL078 proto- (*pre.*) Original, or first, *e.g. proto*blast, the original single-cell stage, from which an embryo develops; *proto*gyny, condition of hermaphrodite organisms in which female elements mature and degenerate before male elements mature; *proto*mitosis, original form of mitosis, as in slime fungi with cruciform divisions; *proto*type, the first specimen of a type of artefact. ↑ CHRON-

AL079 pro- (*pre.*) In front of; before; for, *e.g. pro*enzyme, a substance from which an enzyme is formed, *i.e.* before the enzyme; *pro*lapse, slipping forward, out of place; *pro*climax, a stage in a sere which appears instead of the usual climactic climax; *pro*gnathous, jaws projecting forward; *pro*gnosis, a statement on the future development of a disease. ↑ CHRON-

AL080 post- (*pre.*) After in time; behind, at the back of, in position, *e.g. post*embryonic, the ages, or stages, succeeding the embryonic; *post*mortem, an examination after death; *post*cerebral, posterior to the brain; *post*branchial, behind the gills. ↓ ANTE- (Cn) · PRE (Cn) ↑ CHRON-

AL081 pre- (*pre.*) Before in time; in front of, *e.g. pre*foliation, the grouping of leaves in a bud, *i.e.* before the leaves develop from the bud; *pre*natal, taking place during the period before birth; *pre*mandibular, anterior to a mandible; *pre*hepatic, part of digestive tract anterior to the liver; and also in verbs such as precede, predict, prefabricate, premeditate, prepare. ↓ POST- (Cn) ↑ CHRON-

AL082 ante- (*pre.*) Coming before, in time or in place, *e.g. ante*natal, the period of time before birth; *ante*labrum, the anterior portion of an insect labrum, when differentiated; *ante*rior, the head end of an animal. ↑ CHRON- · POST (Cn)

AL083 meta- (*pre.*) After or behind; a change; among; between, *e.g. meta*carpal, bones after the wrist; *meta*branchial, posterior region of the gill; *meta*chroic, changing colour, as older tissues in fungi do; *meta*chrosis, ability to change skin colour; *meta*centric, having centromeres at, or near, the middle; *meta*genesis, alternation of sexual and asexual generations. ↑ CHRON-

AL084 auto- (*pre.*) Self; caused by, from, itself, *e.g. auto*catalysis, catalysis of a reaction by one of the products of the reaction; *auto*gamy, fertilization of a flower by pollen produced by itself; *auto*lysis, self-digestion of a cell by action of enzymes it has produced itself. ↓ CONTRA- · NEO- ↑ AFFIXATION

AL085 contra- (*pre.*) Opposite in direction or function, *e.g. contra*ception, the action of preventing conception during copulation; *contra*lateral, situated on the opposite side. ↑ AUTO-

AL086 neo- (*pre.*) new, *e.g. neo*cyte, an immature white blood cell; *neo*genesis, formation of new tissue; *neo*natal, recently born or newly hatched. ↑ AUTO-

AL087 chrom- (*pre.*) Colour, *e.g. chroma*tic, to do with colours; *chroma*tism, abnormal coloration of a part of a plant, normally green; *chromo*plast, a coloured plastid. ↓ ERYTHR- · CHLORO- · LEUCO- · MELAN- ↑ AFFIXATION

AL088 erythr- (*pre.*) Red, *e.g. erythro*cyte, a red blood cell; *erythr*ism, a condition in which hair or feathers are extremely red; *erythro*phore, a reddish-purple pigment-containing cell in certain fish. ↑ CHROM-

AL089 chloro- (*pre.*) Green, *e.g. chlor*ine, a yellow-green gas; *chloro*cruorin, a green respiratory pigment in certain worms; *chloro*phyll, green pigment in leaves. ↑ CHROM-

AL090 leuco- (*pre.*) White, *e.g. leuco*cyte, a white blood cell; *leuco*plast, a colourless plastid; *leuco*carpous, with white fruit. ↑ CHROM-

AL091 melan- (*pre.*) Black, *e.g. melan*in, a black or dark-brown pigment, present

in the skin, hair, feathers, of animals; *melan*ophore, a black pigment cell; *melan*ospermous, describes seaweeds with dark-coloured spores. ↑ CHROM-

AL092 dys- (*pre.*) Pain; difficulty; out of order; ill, *e.g. dys*function, not functioning properly; *dys*menorrhoea, painful and difficult menstruation; *dys*entery, inflammation and pain in the intestines, caused by disease. ↓ PATH- · -ASIS · -ITIS · -ALGIA · -AEMIA · -ECTOMY ↑ AFFIXATION

AL093 path- (*pre.*) Suffering, and hence diseased condition, *e.g. path*ological, diseased, unhealthy; *path*ogenic, disease-producing. ↑ DYS-

AL094 -asis, -osis (*suff.*) A diseased condition, either named from the part affected, or from the causative agent, *e.g.* trypanosomi*asis*, infected by trypanosomes, causing disease; filari*asis*, infected by filarial worms; dermat*osis*, any disease of the skin; ket*osis*, excessive formation of ketones in the body, arising from incomplete oxidation of fats. ↑ DYS-

AL095 -itis (*suff.*) Inflammation of a named part, *e.g.* hepat*itis*, inflammation of the liver; dermat*itis*, inflammation of the skin; enter*itis*, inflammation of the intestines. ↑ DYS-

AL096 -algia (*suff.*) Pain, *e.g.* neur*algia*, pain in a nerve. ↑ DYS-

AL097 -aemia (*suff.*) To do with blood, *e.g.* leuk*aemia*, blood condition in which leucocytes are overproduced; hypoglyc*aemia*, too little sugar in the blood; septic*aemia*, blood-poisoning. ↑ DYS-

AL098 -ectomy (*suff.*) Removal by surgical operation, *e.g.* vas*ectomy*, cutting of the vas deferens to sterilize a male; append*ectomy*, removal of the appendix; hyster*ectomy*, removal of the uterus. ↑ DYS-

AL099 aer- (*pre.*) Air; of air, *e.g. aer*ial, inhabiting the air, as of roots and stems; *aer*obic, living only in presence of atmospheric oxygen; *aer*ate, to bubble or pass air through a liquid. ↓ PNEUMO- · ANEMO- · AQUA- · HYDR- · HYGRO- · BENTH- · RHEO- ↑ AFFIXATION

AL100 pneumo-, pneumat- (*pre.*) Air, breath, or gas, *e.g. pneumat*ics, the study of devices and machines which use air or gas to produce a force; *pneumat*ograph, an instrument which records chest movements in breathing; *pneumo*stome, an aperture through which air passes to a respiratory mantle cavity in some gastropods. ↑ AER-

AL101 anemo- (*pre.*) The wind; by the wind, *e.g. anemo*meter, an instrument for measuring wind speed; *anemo*phily, plant fertilization by wind. ↑ AER-

AL102 aqua- (*pre.*) Water; of water, *e.g. aqua*tic, living in water; *aque*duct, a channel or tube for conducting water; *aque*ous, watery, or a solution in water. ↑ AER-

AL103 hydr- (*pre.*) Water; liquids generally, *e.g. hydr*olysis, the splitting of a compound by water, usually requiring a catalyst; *hydr*ophobe, avoiding water, or repelling water; *hydr*ometer, an instrument for measuring the densities of liquids. ↑ AER-

AL104 hygro- (*pre.*) Wet; damp; humid, *e.g. hygro*kinesis, movement in response to changes in humidity; *hygro*meter, instrument for measuring humidity; *hygro*scopic, sensitive to moisture, or attracting and retaining moisture. ↑ AER-

AL105 benth- (*pre.*) The depth of the sea, the sea-bed, or a river-bed, *e.g. benth*ic, living on the sea-bed; *benth*on, the flora and fauna of the sea-bed. ↑ AER-

AL106 rheo- (*pre.*) Flowing; a current, *e.g. rheo*taxis, locomotor response to a current of water or air; *rheo*stat, a variable resistance for adjusting the flow of electric current; *rheo*meter, an instrument for measuring the rate of flow of blood. ↑ AER-

AL107 photo- (*pre.*) Light; using light, *e.g. photo*gen, an organ or substance producing light; *photo*meter, an instrument for measuring the intensity of light; *photo*philous, thriving in strong light. ↓ HELI- · THERM- · GEO- · XERO- · HALO- ↑ AFFIXATION

AL108 heli- (*pre.*) The sun; to do with the sun, *e.g. heli*ophilous, a plant adapted to live in bright sunlight; *heli*otaxis, locomotor response to the stimulus of sunlight; *heli*ograph, an instrument using sunlight to send messages. ↑ PHOTO-

AL109 therm-, thermo- (*pre.*) Heat, *e.g. thermo*meter, an instrument for measuring temperature; *thermo*electricity, an electric current produced by heating a junction of two different metals; *thermo*labile, readily changing its nature when heated; *thermo*chemistry, the study of heat changes accompanying chemical reactions. ↑ PHOTO-

AL110 geo- (*pre.*) The Earth, or to do with the earth, *e.g. geo*phyte, a land plant; *geo*tropism, growing down towards the Earth; *geo*carpic, having fruits which ripen under the ground. ↑ PHOTO-

AL111 xero- (*pre.*) Dry, *e.g. xero*phyte, a plant growing in dry conditions such as a desert; *xero*phobous, not tolerating drought; *xero*phthalma, a disease of the conjunctiva in which it becomes dry and hard. ↑ PHOTO-

AL112 halo- (*pre.*) Common salt; salty; to do with salt, *e.g. halo*phyte, a plant capable of living in salt-impregnated soils; *halo*plankton, minute organisms found in the sea; *halo*gen, chemical elements similar to chlorine, *i.e.* 'salt-producers' because of the similarity of their salts to sodium chloride, or common salt. ↑ PHOTO-

AL113 -ive (*suff.*) **1** Replaces *-ion* in nouns, forming an adjective with the meaning 'describes that which brings about the effect described by the noun', *e.g.* digestion – digest*ive* (that which brings about digestion, such as a digestive juice); conduction – conduct*ive* (brings about conduction); nutrition – nutrit*ive* (brings about nutrition). **2** Forms a noun from the adjective, *e.g.* a purgat*ive* is a substance that brings about purgation. ↓ -OUS · -AL · -ATE · -ACEOUS ↑ AFFIXATION → KNOWLEDGE

AL114 -ous (*suff.*) Generally indicates

possession, or state, *e.g.* tendril–tendrill*ous* (state of possessing tendrils); sympetal*ous*, having fused petals. ↑ -IVE

AL115 -al (*suff.*) Of, or to do with; a general descriptive adjective, *e.g.* dent*al*, of or to do with teeth (compare with dentate); sept*al*, of or to do with septa or partitions (compare with septate); branchi*al*, of or to do with gills. ↑ -IVE

AL116 -ate (*suff.*) Describes a characteristic feature of a structure, *e.g.* verteb*rate*, possessing vertebrae, characteristic of its structure; dent*ate*, with teeth as a characteristic feature; sept*ate*, describes a structure characterized by septa. ↑ -IVE

AL117 -aceous (*suff.*) Having the characteristics of, *e.g.* herb*aceous*, having the characteristics of a herb; membran*aceous*, having the characteristics of a membrane. ↑ -IVE

AL118 -ose[1] (*suff.*) Covered in; full of; having many of; usually as a distinctive feature, *e.g.* lacun*ose*, pitted with small cavities (lacuna, a hole); ram*ose*, very much branched (ramus, a branch); pil*ose*, covered in hair, hairy (*pilus*, a hair); set*ose*, covered with bristles, bristly (*seta*, a bristle). ↓ -IGEROUS · -IFEROUS · -IPAROUS · -IFORM · -OID ↑ -OUS (Sn) · -ACEOUS (Sn) · AFFIXATION

AL119 -igerous (*suff.*) To bear on, or in, a structure, *e.g.* ram*igerous*, bears branches; pil*igerous*, bears hairs; set*igerous*, bears bristles. This suffix is less common than **-iferous.** ↓ -IFEROUS (Sn) ↑ -OSE[1]

AL120 -iferous (*suff.*) To bear; to conduct; to produce, *e.g.* ram*iferous*, bears branches; set*iferous*, bears, or produces, bristles; pil*iferous*, produces hairs; semin*iferous*, produces, and conducts, semen; urin*iferous*, produces and conducts, urine. The suffix is more common than **-igerous** and **-iparous,** and does not usually distinguish between the functions of bearing and producing; it always describes a state of affairs, *i.e.* in ram*iferous*, the plant so described has branches. ↓ -IPAROUS (Sn) ↑ -OSE[1] · -IGEROUS (Sn)

AL121 -iparous (*suff.*) Having the disposition to produce, *e.g.* ram*iparous*, having the disposition to produce branches (not necessarily possessing branches); muc*iparous*, having the disposition to produce mucus (as required by conditions); ov*iparous*, egg-producing, *i.e.* a disposition, as the function is not continuous. ↑ -OSE[1] · -IFEROUS (Sn)

AL122 -iform (*suff.*) Having the form of, *e.g.* ram*iform*, like a branch; pil*iform*, having the form of a hair; petal*iform*, with the form of a petal; ren*iform*, kidney-shaped. ↑ -OSE[1]

AL123 -oid (*suff.*) Resembling in shape, but not in function, or resembling in properties, *e.g.* petal*oid*, like a petal in shape, but describes a structure other than in flowers; rhiz*oid*, resembles a root in its branching structure; ov*oid*, resembles the shape of an egg; metall*oid*, resembles a metal in properties. ↑ -OSE[1]

AL124 -ivorous, -ivore (*suff.*) Eating the named major source of food; **-ivorous** describes the eating habits, **-ivore** names the type of animal, *e.g.* insect*ivorous*, describes an insect-eating animal or plant; carn*ivore*, a meat-eating animal; herb*ivorous*, describes a plant-eating animal; omn*ivore*, names an animal eating both plants and meat. ↓ -PHAGOUS (Sn) · -ICIDE · -CLAST · -LYSIS · -PHOBE · -PHILE

AL125 -phagous, -phage, -phagy (*suff.*) Eating the named major source of food; **-phagous** describes the eating habits, **-phage** names the type of organism, **-phagy** names the phenomenon, *e.g.* sarco*phagous*, meat-eating; entomo*phagous*, insect-eating; entomo*phagy*, the phenomenon of existing on a diet of insects; phyto*phagous*, plant-eating; erythro*phage*, a cell destroying erythrocytes by ingestion; haemato*phagous*, describes an organism feeding on blood. ↑ -IVOROUS (Sn)

AL126 -icide (*suff.*) A killer of a named animal, *e.g.* insect*icide*, a substance which kills insects; mollusc*icide*, a substance which kills molluscs; larv*icide*, a substance which kills larvae; hom*icide*, a person who kills a human being. ↑ -IVOROUS

AL127 -clast, -clasis (*suff.*) A destroyer; an agent which breaks down materials; **-clast** names the agent of destruction, **-clasis** the action of destruction, *e.g.* chondro*clast*, a cell which destroys cartilage matrix; haemo*clasis*, the destruction of blood cells; osteo*clast*, a cell which destroys bone matrix. ↓ -LYSIN, LYSIS (Sn) ↑ -IVOROUS → -BLAST (An)

AL128 -lysis, -lytic, -lyse, -lysin (*suff.*) The break-down of a cell, tissue, or substance to set free the contents, or different substances, especially into solution; **-lysis** is the action of breaking down; **-lytic** describes the agent; **-lyse** is the verb of action; **-lysin** names the agent, *e.g.* cyto*lysis*, the dissolution, or breaking down, of a cell; haemo*lytic*, describes an agent that breaks down and dissolves the contents of erythrocytes; bacterio*lysin*, is the name of any substance which breaks down a bacterial cell by lysis; osteo*lysis*, the breaking down of bone matrix; pyro*lysis*, the breaking down of a compound by heat; electro*lyse*, to break down a compound by an electric current. ↑ -IVOROUS · -CLAST · -CLASIS (Sn)

AL129 -phobe, -phobia, -phobic (*suff.*) A dislike of named conditions; **-phobe** names the organism, **-phobia** names the phenomenon, **-phobic** describes the organism, *e.g.* photo*phobe*, an organism which dislikes light, and thrives in the dark; hydro*phobic*, describes a substance, such as a colloid, not readily dissolving in water; lyo*phobe*, a colloid readily coming out of solution (dislikes the solvent). ↓ -PHILE (Cn) ↑ -IVOROUS

AL130 -phile, -phily, -philic, -philous (*suff.*) A like of, or a preference for, a named condition; **-phile** names the organism, **-phily** names the phenomenon, **-philic** and **-philous** describes the organism,

e.g. photo*philous* describes an organism seeking or thriving in light; hydro*phile*, a colloid with a strong liking for water; sym*phily*, the relation in which an animal likes, and lives in, the society of other animals; halo*phile*, a plant preferring to live in salt water; lyo*philic*, describes a colloid going readily into solution. ↑ -IVOROUS · -PHOBE (Cn)

AL131 -escence (*suff.*) A process of development or growth, *e.g.* turg*escence*, the state of becoming turgid; sen*escence*, growing old; lumin*escence*, the process of giving out light; turg*escent*, becoming turgid; lumin*escent*, giving out light. —ESCENT (*suff.*) ↓ -STASIS · -GENESIS · -AD

AL132 -stasis (*suff.*) A stopping, slowing down, or standing still, *e.g.* bacterio*stasis*, stopping bacterial growth, so that the population stands still; haemo*stasis*, stopping bleeding; thermo*stat*, a device for maintaining a constant temperature; hydro*static*, to do with liquids at rest. —STAT, STATIC (*suff.*) ↑ -ESCENCE

AL133 -genesis (*suff.*) Formation; process of development; act of production, *e.g.* spermato*genesis*, the producing of spermatozoa; oo*genesis*, the production of ova; hetero*genesis*, alternation of generations. ↑ -ESCENCE

AL134 -ad (*suff.*) To, in the direction of; used to replace **-al** in adjectives to form an adverb, *e.g.* each testis lies dorsolater*ad* (in a dorsolateral direction). ↑ -ESCENCE

AL135 -gram (*suff.*) That which is written or drawn, *e.g.* sphygmo*gram*, a record of the pulse made by a sphygmograph; cardio*gram*, a record of the heart-beat; tele*gram*, a message written down by a telegraph; spectro*gram*, a photograph of a spectrum. ↓ -GRAPH · -METER · -SCOPE · -METRY · -SCOPY

AL136 -graph (*suff.*) That which writes or draws, *e.g.* sphygmo*graph*, an instrument for recording the pulse; cardio*graph*, an instrument for recording heart-beat; baro*graph*, an instrument which makes a written record of atmospheric pressure. ↑ -GRAM

AL137 -meter (*suff.*) An instrument which measures accurately, *e.g.* am*meter*, measures electric current in amperes; oh*meter*, measures electrical resistance in ohms; baro*meter*, measures atmospheric pressure; pyro*meter*, measures high temperatures. ↑ -GRAM

AL138 -scope (*suff.*) An instrument for observation and for qualitative measurement, *e.g.* spectro*scope*, an instrument for forming and observing spectra (contrast spectrometer, for making accurate measurements on spectra); thermo*scope*, an instrument for detecting, but not measuring, changes in temperature; galvano*scope*, an instrument for detecting electric current. ↑ -GRAM

AL139 -metry (*suff.*) The science of measurement, *e.g.* hygro*metry*, the science of measuring humidity; geo*metry*, the science of measuring the earth; pyro*metry*, the science of measuring high temperatures. ↑ -GRAM

AL140 -scopy (*suff.*) Indicates the using of an instrument for observation, *e.g.* spectro*scopy*, using a spectroscope; micro*scopy*, using a microscope. ↑ -GRAM

AL141 scientific word building (*n.*) Words in science, as in other branches of knowledge, are either simple, *e.g. carry, cold, atom,* or complex. Complex words are either composite or compound. A composite word is formed from a simple word with one, or more, affixes, *e.g.* in*born*, *crystal*lize, super*conduc*tion. Compound words are either simple words joined together, *e.g.* test-tube, corkborer, or are formed from one, two, or more, meaningful segments which do not themselves exist as simple words. These segments are mainly derived from Greek words, although there are some derived from Latin words; they are used in certain combinations for special science terms. The following examples illustrate the way in which compound words are formed; a knowledge of such segments is useful in trying to understand the meaning of a term, but they should not be used to build words, as only certain combinations are permissible. The compound words formed from segments undergo affixation in the normal way to become composite words, *e.g. a gam* is a segment meaning fertilization; *gen* is a segment meaning to produce; *sis* is a segment meaning a state; *gamogenesis* is sexual reproduction; *b cyto* means a cell; *lys* means to dissolve; *sis* means a state; *cytolysis* is cell dissolution; *c patho* means disease, suffering; *gen* means produce; *pathogen* is an agent causing disease; *pathogenic* (*adj.*) uses the *-ic* adjective-forming suffix. ↓ GEN · AUX · COEL · HAEM · HIST · OSTEO · PTERA · PHYLL ↑ KNOWLEDGE

AL142 gen Connected with production or formation, *e.g. gen*erator, a device for producing steam, electric current, or a gas; *gene*, a unit factor of inheritance; syn*gen*etic, reproducing sexually; patho*gen*, a micro-organism causing disease; peri*gen*ous, growing on all sides of a structure. ↓ GON · GAM · ANDR · GYN ↑ SCIENTIFIC WORD BUILDING

AL143 gon Connected with reproduction, *e.g.* *gon*oduct, a duct leading from a gonad to the exterior; *gon*idiferous, producing gonidia—minute reproductive bodies of bacteria; arche*gon*ium, a female gametangium in lower plants; schizo*gony*, cleavage multiplication in unicellular animals. ↓ -GAM- (Sn) ↑ GEN

AL144 gam Connected with reproduction resulting from fertilization, *e.g.* *gam*ic, fertilized; *gam*ete, a sexual reproductive cell; aniso*gam*etism, the production of both macrogametes and microgametes; macro*gam*ete, the larger of two conjugants; syn*gam*etic, describes the union of morphologically similar sex cells; poly*gam*ous, describes individuals with more than one mate at a time; mono*gam*y,

the state of mating with one member only of the opposite sex. ↑ GAM (Sn) · GEN

AL145 andr Male; male characteristics or structures, *e.g. andr*ogyne, an individual plant bearing separate male and female flowers; gyn*andr*omorph, an individual with a spatial mosiac of male and female characteristics; hol*andr*ic describes a characteristic transmitted through Y-chromosomes; poly*andr*ous descibes a female mating with more than one male; mon*andr*y, the state of mating with one male. ↓ GYN (An) ↑ GEN

AL146 gyn Female; female characteristics or structures, *e.g. gyn*atrium, a female genital pouch; *gyn*androus, having stamens fused with pistils; hetero*gyn*ous, describes a species with two types of female; poly*gyn*y, the state of mating with more than one female. ↑ ANDR (An) · GEN

AL147 aux To grow; to increase, *e.g. aux*in, growth-regulating hormone in plants; *aux*otonic, induced by growth; hetero*aux*in, growth-promoting hormone extracted from fungi. ↓ KIN · BIO ↑ SCIENTIFIC WORD BUILDING

AL148 kin Motion; movement, *e.g. kin*etic, of, or to do with, or caused by, motion; *kin*aesthetic, sense of movement; hygro*kin*esis, movement in response to a change in humidity; thrombo*kin*ase, an enzyme participating in blood clotting. ↑ AUX

AL149 bio To do with life; living, *e.g. bio*synthesis, synthesis of chemical compounds by living organisms; *bio*psy, examination of living organs, tissues; sym*bio*sis, two organisms living in mutually beneficial partnership; aero*bio*tic, living mainly in the air; anti*bio*nt, any antibiotic organism. ↑ AUX

AL150 coel A hollow or cavity, *e.g. coel*enteron, body cavity of coelenterates; *coel*omoduct, a duct from the body cavity to the exterior; haemo*coel*, expanded portion of blood system which replaces the true coelom; a*coel*omate, without a true coelom. ↓ THECA · ZYG · MORPH · KARY ↑ SCIENTIFIC WORD BUILDING

AL151 theca A receptacle, vessel or container, *e.g. theca*l, surrounded by a protective membrane; *theca*sporous, having spores enclosed; sperma*theca*, a sac for storing spermatozoa; karo*theca*, nuclear membrane; endo*the*cium, inner coat of a cell in an anther. ↑ COEL

AL152 zyg A yoke, joining two parts, *e.g. zyg*omorphic, having bilateral symmetry; *zyg*ote, a cell formed by the union of two sex-cells; homo*zyg*ous, having identical genes for a given characteristic; hetero*zyg*ote, an organism with allelomorphs of a gene. ↑ COEL

AL153 morph Shape; form; forming, *e.g. morph*ogenesis, origin of development of organs or parts of organisms; *morph*ology, the study of the shape of organisms, and crystalline structures; poly*morph*ism, occurrence of different forms of individuals in the same species; allelo*morph*, one of a pair of alternative genes. ↑ COEL

AL154 kary, cary Nucleus of a cell; a nut, *e.g. kary*okinesis, division of a cell into two haploid daughter cells; *kary*oplasm, the substance in a cell nucleus; *cary*opsis, a cereal grain; hetero*kary*osis, having genetically dissimilar nuclei; hemi*kary*on, a nucleus with a haploid number of chromosomes. ↑ COEL

AL155 cary Alternative spelling for KARY. ↑ COEL

AL156 haem[1] Blood, *e.g. haem*al, to do with blood, or blood vessels; *haem*oglobin, respiratory pigment in blood; anti*haem*orrhagic, promoting blood clotting. ↓ CHONDR · DERM · CYT · BLAST ↑ SCIENTIFIC WORD BUILDING

AL157 chondr Cartilage; cartilage forming, *e.g. chondr*oclast, a cell destroying cartilage matrix; *chondr*ocyte, a cartilage cell; peri*chondr*ium, fibrous membrane surrounding cartilage. ↑ HAEM[1]

AL158 derm The skin, *e.g. derm*atosis, any disease of the skin; *derm*atophyte, a fungal parasite on the skin; epi*derm*is, the outer layer of the skin; endo*derm*, the innermost layer of a triploblastic embryo. ↑ HAEM[1]

AL159 cyt Cell, *e.g. cyt*oplasm, protoplasm in a cell apart from the nucleus; *cyt*ostome, mouth of a unicellular animal; pinoc*yt*osis, ingestion of droplets by cells; leuco*cyte*, a white blood cell. ↑ HAEM[1]

AL160 blast A bud, germ, group of cells, or cell, forming the first stage in development, *e.g. blast*ocyte, any undifferentiated cell in an embryo; *blast*ogenesis, reproduction by budding; chondro*blast*, a cartilage-producing cell; diplo*blast*ic, having only ectoderm and endoderm, as in coelenterates. ↑ HAEM[1]

AL161 hist Tissues of living organisms, *e.g. hist*oblast, a unit of tissue; *hist*ology, the study of tissues and of tissues in organs; anti*hist*amine, a substance which prevents the action of a histamine. ↓ PLASM · LIP · MYEL · MYO ↑ SCIENTIFIC WORD BUILDING

AL162 plasm Formed or shaped, usually referring to the living cell substance in all organisms, *e.g. plasm*odium, a multinucleate mass of protoplasm; proto*plasm*, the living substance of a cell; *plasm*agene, a heritable protein unit in cytoplasm; pseudo*plasm*odium, an aggregation of plasmodia without fusion of their protoplasm. ↑ HIST

AL163 lip Fat, or fatty substance, *e.g. lip*ase, a fat-splitting enzyme; *lip*ocyte, a cell containing fat; phospho*lip*ids, a fat containing nitrogen and a phosphate group. ↑ HIST

AL164 myel The marrow of a bone, or a soft substance surrounded by bone, or a substance similar to marrow, *e.g. myel*oblast, an undifferentiated cell of bone marrow; *myel*ocoel, the canal of the spinal cord; polio*myel*itis, inflammation of the grey matter in the spinal cord. ↑ HIST

AL165 myo Muscle, *e.g. myo*cyte, a contractile cell, or a muscle cell;

*myo*haematin, a pigment of muscle tissue; neuro*myal*, junction of end plate of nerve and muscle as a functional unit; endo*my*sium, connective tissue binding muscle fibre. ↑ HIST

AL166 osteo Bone, *e.g. osteo*logy, the study of the structure and development of bones; *osteo*cyte, a bone cell, surrounded by bone matrix; perio*steum*, fibrous membrane investing a bone. ↓ REN · ENTERO · GASTRO · HEPAT ↑ SCIENTIFIC WORD BUILDING

AL167 ren, reni A kidney, *e.g. reni*culus, a kidney lobe; supra*renal*, glands situated near the kidneys; *renal*, of, or to do with, the kidneys; inter*renal*, describes a gland of elasmobranchs, representing the adrenal cortex of vertebrates. ↑ OSTEO

AL168 entero, enter The gut, particularly the intestines, *e.g. enteron*, the gut of animals; *entero*coel, a coelom arising as a pouch-like outgrowth; coel*enteron*, the body cavity, in diploblastic animals, in which food is digested; dys*entery*, inflammation of the intestines caused by disease. ↑ OSTEO

AL169 gastro, gastr The stomach, or to do with digestion, *e.g. gastral*, to do with the stomach; *gastrula*, a cup-shaped embryo, formed by invagination from a blastula; hypo*gastrium*, the lower region of the stomach; *gastropoda*, a class of Molluscs, means 'stomach-foot'. ↑ OSTEO

AL170 hepat Liver, or to do with the liver, *e.g. hepatic*, to do with the liver; *hepatology*, the study of the structure and functions of the liver. ↑ OSTEO

AL171 ptera, pter A wing, or a structure resembling a wing, *e.g. pteropodium*, a winged foot, as possessed by some bats; *pterygotous*, having wings, describing insects; *pterygoid*, describes a wing-like process of a bone; exo*pterygota*, a class of insects in which the wings develop from folds on the outside of the body; Di*ptera*, order of insects with two wings. ↓ PINNA[1] · DACTYL · POD[1] · CAUD · SOM · GNATH · STOM ↑ SCIENTIFIC WORD BUILDING

AL172 pinna[1] A feather, or any feather-like part such as a leaf, or a fin, *e.g. pinnate*, describes a compound leaf divided in a feathery manner; *pinnule*, a secondary leaflet on a compound leaf; bi*pinnate*, having leaflets growing in pairs on paired stems; *pinnatiped*, having lobed toes, as certain birds. ↑ PTERA

AL173 dactyl A digit on an appendage, such as a finger, or toe, *e.g. dactylor*, of or describing a finger or digit; *dactylus*, part of the tarsus of an insect; penta*dactylism*, the state of possessing five digits on all four limbs of a vertebrate; mono*dactylous*, with one digit, or one claw only; tetra*dactyl*, having four digits on an appendage. ↑ PTERA

AL174 pod[1] A foot, *e.g. podite*, the walking leg of a crab; pseudo*podium*, a projection of protoplasm used for locomotion in amoeboid movement; pro*podium*, the anterior part of the foot of a mollusc; cephalo*pod*, a marine mollusc with muscular arms on head region. ↑ PTERA

AL175 caud A tail, *e.g. cauda*, a tail, or a tail-like appendage; *caudostyle*, a terminal structure in some parasitic amoeboid animals; *ecaudate*, without a tail. ↑ PTERA

AL176 som The body of an organism as distinct from the parts concerned with reproduction, *e.g. somatic*, to do with the body, as opposed to *germinal*; *soma*, the body of an animal or a plant as a whole, except the germinal cells; chromo*some*, a rod-like coloured body in a nucleus; hypo*somite*, ventral part of a body segment. ↑ PTERA

AL177 gnath To do with the jaw, or biting, *e.g. gnathostomatous*, with jaws at the mouth; *gnathites*, the buccal appendages of arthropods; holo*gnathous*, having the jaw in one piece; a*gnathostomatous*, having a mouth without jaws. ↑ PTERA

AL178 stom A mouth, or opening, *e.g. stomions*, dermal pores in a developing sponge; *stomatal*, like, or to do with, the openings (stomata) in a leaf surface; hypo*stomatous*, having stomata on the under surface of a leaf; ana*stomose*, (of ramification of vessels) to unite through many mouths; peri*stome*, region surrounding the mouth. ↑ PTERA

AL179 phyll A leaf, or leaf-like, *e.g. phyllome*, the leaf structures of a plant, as a whole; *phyllopodous*, having leaf-like swimming feet; mega*phyllous*, having relatively large leaves on a plant; meso*phyll*, the spongy middle layer of a leaf; sporo*phyll*, a leaf bearing a sporangium. ↓ CARP · RAM · CAUL[2] · RHIZ · PHYTO ↑ SCIENTIFIC WORD BUILDING

AL180 carp A fruit, *e.g. carpophagous*, feeding on fruit; *carpogenous*, growing on, or in, fruit such as fungi; meso*carp*, the middle layer of the pericarp of a fruit; acro*carpic*, bearing fruit which terminates the axis. The segment **carp** also denotes the wrist, as in **carpal,** a wrist bone, but derivatives are less common. ↑ PHYLL

AL181 ram A branch, *e.g. ramification*, the state of being much branched; *ramus*, any branch-like structure; multi*ramose*, much branched. ↑ PHYLL

AL182 caul[2] A stem, or a stalk, *e.g. caulotaxis*, the arrangement of branches on a stem; *caulome*, the stem structure of a plant as a whole; multi*caul*ine, with many stems; amplexi*caul*, surrounding the stem, as of leaf-base. ↑ PHYLL

AL183 rhiz A root, *e.g. rhizomorph*, a root-like hypha in certain fungi; *rhizogenic*, root producing, as certain plant cells; phyllo*rhiza*, a young leaf with a root; coleo*rhiza*, the thin outer layer of a root on a young plant. ↑ PHYLL

AL184 phyto, phyte A plant, *e.g. phytoparasite*, any parasitic plant; *phytomer*, a structural unit of a plant; cormo*phyte*, a plant possessing stem and root; holo*phytic*, obtaining the whole of its food in the manner of a plant. ↑ PHYLL

Statement

AM001 statement (*n.*) A statement is the vehicle by which we move from thought to language; it finds expression as a spoken or written sentence, *e.g.* the sentence 'The horse is a quadruped' is a statement in the English language which refers to a collection of related concepts in thought. Different sentences in different languages, including the languages of symbols, are statements of the same related concepts in thought. A statement can be discussed or explained; it can be true or false □ *a* statement *is* made *by a person* —***state*** (*v.*) ↓ STUDY[1] · ASSERTION · GENERALIZATION · STUDY[2] · STATE[1] · FUNDAMENTAL[1] · APPARENT · ORDINARY · CRITERION → KNOWLEDGE · PERCEPT

AM002 study[1] (*n.*) The seeking of knowledge or the acquiring of information in some branch of learning, *e.g.* the study of electricity. —STUDY (*v.*) ***student*** (*n.*) ↓ ASSUMPTION · POSTULATE · DISTINCTION · INFERENCE · EVIDENCE · DEDUCTION · INDUCTION[1] · CONCLUSION ↑ STATEMENT

AM003 assumption (*n.*) That which is assumed, *i.e.* a fact that is taken to be true without evidence □ *an unwarranted/correct/valid/basic/incorrect assumption* ↑ STUDY[1]

AM004 postulate (*n.*) An underlying assumption taken as the basis of an action or as the basis for a process of thought; the postulate is accepted as true, and it is accepted that the postulate cannot be proved, *e.g.* the existence of space is a postulate. Compare an **assumption**, which can be brought in at any stage of a process of thought or a particular discussion, but a postulate has to be a necessary starting point of a discussion or process of thought. —***postulate*** (*v.*) ↑ STUDY[1] → ASSUME

AM005 distinction (*n.*) A difference showing that one object or concept is unlike another. Those properties, features, or qualities which distinguish A from B or make the distinction between A and B. To make a distinction between A and B is to distinguish A from B □ *a clear/slight distinction; to make/draw a distinction; a distinction between* ↑ STUDY[1] → DISTINGUISH

AM006 inference (*n.*) The act or result of forming conclusions by logical reasoning. An inference is a statement which we can make about a subset because we have information about another subset or the total set. There are three types of inference.

Direct inference The properties of a subset are known; we infer that the properties of the total set are the same, *e.g.* an observer determines the properties of a sample of water (such as colour, taste, odour, density). He infers that all water everywhere has the same properties.

Inverse inference The properties of a total set are known; we infer that the properties of a subset are known, *e.g.* the properties of lead (II) nitrate are known (in this case, the total set of all lead (II) nitrate everywhere); we infer that any particular sample of lead (II) nitrate will have the same properties.

Predictive inference. The properties of a subset A are known; the properties of a subset B are determined. If the properties of the two subsets are the same, we infer that both belong to the same total set, *e.g.* an observer knows the properties of a sample of lead (II) nitrate (such as on heating it decomposes to liberate nitrogen dioxide and oxygen and to form lead (II) oxide). He observes the properties of a sample substance. If its properties are the same as those of the sample of lead (II) nitrate, he infers that the sample substance is lead (II) nitrate □ *to make an inference* ↓ DEDUCTION (H) · INDUCTION[1] (H) ↑ STUDY[1] → OBSERVATION · TEST

AM007 evidence (*n.*) The observations or generalizations on which a law, hypothesis, principle, or theory may be based, *e.g.* ***a*** the theory of evolution is based on evidence from fossils (observations), from comparative anatomy (generalizations), and from vestigial organs (observations); ***b*** evidence for the wave theory of light is obtained from experimental observations on interference and diffraction □ *evidence for a theory or evidence against a theory can be obtained from observations; evidence is advanced in support of the theory of evolution; evidence can be offered, put forward, or provided; in qualitative analysis, the absence of a precipitate is negative evidence that certain ions are not present; the observations on diffraction are positive evidence for the wave theory of light* —***evident*** (*adj.*) ↑ STUDY[1]

AM008 deduction (*n.*) Coming to the conclusion using known or supposed facts. A deduction is an inverse inference in which all the facts are known or supposed to be true □ *to make a deduction; deductive reasoning/inference* —***deduce*** (*v.*) ***deductive*** (*adj.*) ↑ STUDY[1]

AM009 induction[1] (*n.*) The process of making a generalization from a particular sample. It is an example of direct inference. —INDUCTIVE (*adj.*) ↑ STUDY[1]

AM010 conclusion (*n.*) A decision arrived at by reason □ *to draw a conclusion* —***conclude*** (*v.*) ***conclusive*** (*adj.*) ***conclusively*** (*adv.*) ↑ STUDY[1]

AM011 assertion (*n.*) A definite statement declared to be true. —ASSERT (*v.*) ↓ ACCOUNT · GENERALIZATION ↑ STATEMENT → FUNDAMENTAL

AM012 account (*n.*) A statement which describes an event, process or behaviour and explains the underlying reasons, *e.g.* giving an account of the oxides of lead means describing the events (reactions) in which the oxides take part and explaining the reasons for their behaviour □ *to give*

write an account; a brief/detailed/full account ↑ ASSERTION

AM013 generalization (*n.*) The process or result of making a statement about a class of objects from a statement about one individual object or a statement about a few individuals. A generalization is a jump from a number of *singular* statements to a *universal* statement.

A **singular statment** is one made about individual objects, organisms, concepts, *e.g.* 'this man has hair' is a singular statement about one particular man; it is based on observations. Similar statements can be made about other men, or other animals, *e.g.* this cat has hair.

A **universal statement** is one made about a whole class of objects, organisms, etc., *e.g.* all men have hair and all mammals have hair are universal statements made by generalization of the singular statements above. Note that generalizations are not necessarily true. They are only true within the limits of the original observations. ↓ EMPIRICAL GENERALIZATION · RULE[1] ↑ STATEMENT → HYPOTHESIS

AM014 empirical generalization (*n.*) A generalization made from observation or experimental evidence. ↑ GENERALIZATION

AM015 rule[1] (*n.*) A statement of the method to determine the relation between specified physical quantities, or a generalization founded on observations, *e.g.* ***a*** Fleming's Left-Hand Rule in which the thumb and first two fingers are placed mutually at right angles to represent the movement of a conductor and the two physical quantities of electric current and magnetic field (the rule determines the relation between the quantities). ↑ GENERALIZATION · METHOD

AM016 study[2] (*v.t.*) **1** To make a study of a subject, *e.g.* to study physics. **2** To observe carefully and closely in order to perceive details, *e.g.* to study an object mounted under a micro-scope. ↓ ASSUME · SPECULATE · DISTINGUISH · RECONCILE · ABSTRACT[1] ↑ STATEMENT

AM017 assume (*v.t.*) To take a statement or a fact to be true for the purpose of a particular discussion, and not necessarily to have to prove or to show it to be true during the discussion, *e.g.* ***a*** assume molecules to be completely elastic in gaseous collisions; ***b*** assume the formula for the volume of a sphere in a calculation; ***c*** assume the value of gravitational acceleration to be 10 m s^{-2} (correct value is 9.780 m s^{-2} at the equator) in order to make calculation easier. —ASSUMPTION (*n.*) ***assumed*** (*adj.*) ↑ STUDY[2]

AM018 speculate (*v.i.*) **1** To think very carefully about considering all the possibilities and probabilities. **2** To think about or reflect upon a matter, especially something involving guesswork, imaginative hypothesis, or inference from incomplete evidence. —***speculation*** (*n.*) ***speculative*** (*adj.*) ↑ STUDY[2]

AM019 distinguish (*v.t.,i.*) To recognize a difference between forms of matter or forms of radiation as we perceive them or think about them ☐ *distinguish between A and B; distinguish A from B* —DISTINCTION (*n.*) ***distinguishable, distinguishing,*** DISTINCTIVE (*adj.*) ↑ STUDY[2] → CONTRAST · COMPARE

AM020 reconcile (*v.t.*) To remove an apparent difference of opinion, or fact, between two statements in order to bring the statements into correspondence, *e.g.* to modify a theory or a law to reconcile it with further experimental evidence, such as the modification of Boyle's Law (1662) by van der Waals (1873) which reconciles the results of Andrews' experiments (1869) with the Gas Law. —***reconciliation*** (*n.*) ↑ STUDY[2] → MODIFY

AM021 abstract[1] (*v.t.*) To take a unifying concept from a collection of associated concepts, *e.g.* a liquid is heated in a flask and boils; the vapour is led through a condenser; the condensed liquid is collected in a receiver. Each part of the process has its own concepts, which are associated in the process. A unifying, (or more basic concept) of distillation is abstracted from these associated concepts. Abstraction is a process of thought; and the final abstraction is not identical to any one percept. The abstraction of the term, cat, after seeing many cats, gives rise to a concept for which there is no actual percept. A typical cat can be drawn, which everyone will recognise, although no such particular cat exists. —***abstraction*** (*n.*) ABSTRACT (*adj.*) ↑ STUDY[2] → CONCRETE

AM022 state[1] (*v.t.*) To make a statement, *e.g.* Boyle's Law can be stated both in words and in symbols. —STATEMENT (*n.*) ↓ ASSERT · EXPLAIN · COMMENT · DISCUSS · ACCOUNT FOR · DEDUCE · CLARIFY ↑ STATEMENT

AM023 assert (*v.t.*) To make a statement and say that it is true. —ASSERTION (*n.*) ↑ STATE[1]

AM024 explain (*v.t.*) To make a statement or series of statements and to give reasons for each assertion ☐ *explain in full* or *explain in detail the application of Boyle's Law to a non-ideal gas; explain briefly the difference between an ideal and a non-ideal gas* —***explanation*** (*n.*) EXPLANATORY (*adj.*) ↑ STATE[1]

AM025 comment (*v.i.*) To write a brief explanation as to the truth or falsity of a given statement ☐ *to comment on/about* —COMMENT (*n.*) ↑ STATE[1]

AM026 discuss (*v.t.,i.*) To put forward reasons for and against a statement in spoken words or in writing ☐ *to discuss in detail* ↑ STATE[1]

AM027 account for (*v.t.*) To give reasons for a set of assertions or a state of affairs. ↑ STATE[1]

AM028 deduce (*v.t.*) To use known or supposed facts to form a conclusion. The conclusion must be supported by all the facts, *e.g.* to take a series of readings from the electric current passing through a

resistor when the potential difference is varied (the known facts) and to deduce that the current is directly proportional to the potential difference. —***deduction*** (*n.*) ***deductive*** (*adj.*) ↑ STATE[1]

AM029 clarify (*v.t.*) To make clear, *e.g.* the distinction between real and virtual images can be clarified by drawing ray diagrams. —***clarification*** (*n.*) ↑ STATE[1] → CLEAR[2]

AM030 fundamental[1] (*adj.*) Describes an object, process or idea that cannot be derived, over which we have no choice, *i.e.* one that is a foundation or base for other objects, processes or ideas, *e.g.* ***a*** **fundamental particles** are the sub-atomic particles that make up all matter; ***b*** fundamental quantities are physical quantities on which other physical quantities are based. ↓ BASIC[1] · SPECIAL · GENERAL · COMMON · COMMONLY · PARTICULAR · DISTINCTIVE · ANOMALOUS · VITAL[1] ↑ STATEMENT

AM031 basic[1] (*adj.*) A chosen fact, idea or concept is basic if it forms a foundation or beginning to the development of an investigation, study, theory or any process of thought □ *a basic assumption; the basic facts; the basic principles; a basic concept; the basic idea.* ↑ FUNDAMENTAL → ESSENTIAL

AM032 special (*adj.*) **1** (G.S.) Marked off from the others of the same kind by some distinguishing feature or quality. **2** (Ph.) (Of a law or theory) having a limited application, *e.g.*Snell's Law states the relation between the angle of incidence and the angle of refraction; this is the general application. A special application of the Law is the angle of incidence (the critical angle) which gives an angle of refraction of 90° for light passing from a dense to a less dense medium. In many instances the special case has a specific term to describe it. —SPECIALIZATION (*n.*) ***specialize*** (*v.*) ↑ FUNDAMENTAL[1] → UNIVERSAL

AM033 general (*adj.*) **1** (Bio., Ch., Ph.) Describes properties, characteristics, and qualities which are common to individuals or items in a category. The term contrasts with **particular** which describes additional properties, etc., which apply to an individual or an item in the category, *e.g.* the general properties of acids are common to all acids; any one acid has its own particular properties in addition to the general properties. A general statement is true in most cases, but not without exception, *e.g.* it is generally true that metals displace hydrogen from acids, but there are exceptions to this rule. Here the term is in contrast with **universal,** where there are no exceptions □ *a general description* **2** (Ph.) Describes a theory that can be used in all cases. This is in contrast with **special** which describes a theory of limited application. —GENERALIZATION (*n.*) ***generalize*** (*v.*) ↑ FUNDAMENTAL

AM034 common (*adj.*) **1** Describes a property, feature, etc., belonging to two or more objects, substances, or organisms, *e.g.* ***a*** a common feature of reptiles is that they are all completely covered with scales, *i.e.* this feature of scales is *common to* all reptiles, or, being completely covered with scales is a feature *in common* which all reptiles have; ***b*** the core of a transformer and a resistor have a common connection to earth, *i.e.* they both use the same connection. **2** (G.S.) Found everywhere, of frequent occurrence, or of frequent use, *e.g.* the Common African Toad (found everywhere in Africa, and more often than other species of toads). —***commonly*** (*adj.*) ↑ FUNDAMENTAL[1] → RARE (An)

AM035 commonly (*adv.*) More frequently; the use of this term sometimes suggests that exceptions may be found to the statement, *e.g.* the statement 'Toads are found more commonly during the wet season' also suggests that toads are found outside the wet season, but in fewer numbers. ↑ FUNDAMENTAL[1]

AM036 particular (*adj.*) Describes a definite individual, item in a category, member, or a definite sub-set of members, in a set. A particular item is an item considered by itself or distinguished from other members of the group, *e.g.* the study of the properties of particular acids, such as hydrochloric, sulphuric, ethanoic, shows their own particular properties; those properties they have in common are the general properties of acids □ *a particular individual in a group* —***particularize*** (*v.*) ↑ FUNDAMENTAL[1]

AM037 distinctive (*adj.*) Describes those properties, features, or qualities which are readily perceivable and are the most obvious, *e.g.* ***a*** ammonia has a distinctive smell; ***b*** a tiger has distinctive markings; ***c*** polished copper has a distinctive lustre. ↑ FUNDAMENTAL[1] · DISTINGUISH

AM038 anomalous (*adj.*) Describes any property of an object, or any property or behaviour of a substance, or any behaviour of an individual, that does not follow a general rule or is not representative of its class, *e.g.* ***a*** the general rule is that the density of liquids increases as their temperature decreases, but the behaviour of water is anomalous, as it has a maximum density at 4°C; ***b*** the duck-billed platypus is a mammal which is not representative of its class as it lays eggs; its behaviour is anomalous. —***anomaly*** (*n.*) ↑ FUNDAMENTAL[1]

AM039 vital[1] (*adj.*) Describes an object, radiation or process which is absolutely necessary for some stated process or effect to occur or take place, *e.g.* chlorophyll is vital in photosynthesis (photosynthesis will not take place if chlorophyll is not present) □ *a vital role* ↑ FUNDAMENTAL

AM040 apparent (*adj.*) Describes a property, quantity or measurement that appears to be correct to the senses or by experiment, but is not supported by scientific evidence or is known not to be absolutely true, *e.g.* ***a*** the solid had an apparent loss of weight when it was heated (the loss of weight appeared to occur, but was not conclusively

proved); ***b*** the apparent relative molecular mass (molecular weight) of an electrolyte may differ from the actual (true) relative molecular mass because of ionization in solution. **2** Describes something that is clearly seen and accepted to be true, *e.g.* it is apparent that Dalton's view of the atom can no longer be held. ↓ PLAUSIBLE · DUBIOUS · UNWARRANTED · EVIDENT · EXPLANATORY ↑ STATEMENT

AM041 plausible (*adj.*) An argument or statement is plausible if it appears to have no obvious faults and can reasonably be accepted as true. —***plausibility*** (*n.*) ↑ APPARENT

AM042 dubious (*adj.*) A statement is dubious if its value or truth is uncertain, but the person reading or hearing the statement varies between accepting and doubting it. Thus **doubtful** is more definite in meaning than dubious, *e.g.* an observer does not know whether to accept a dubious value of the resistance of a resistor, but if the value is doubtful, he does not accept it. —***dubiety*** (*n.*) ↑ APPARENT

AM043 unwarranted (*adj.*) Any generalization, or assumption, for which no adequate reason or basis of fact can be given, is said to be unwarranted. ↑ APPARENT

AM044 evident (*adj.*) Describes a fact, statement or state of affairs which is supported by evidence, *i.e.* the evidence shows why the fact, etc., is true, *e.g.* measurements on the osmotic pressure of electrolytes in solution show that the number of particles present is greater than the theoretical number of molecules, so it is evident that there is dissociation of the electrolyte into ions. To contrast **evident** and **apparent**; when a body is weighed in air and then weighed submerged in water, there is an *apparent* loss in weight (as observed by the senses) but according to scientific study there is no *evident* loss in weight as the weight of an object is constant at any one place. ↑ APPARENT

AM045 explanatory (*adj.*) Having the purpose of explanation, *e.g.* ***a*** an explanatory note to a text; ***b*** an explanatory diagram to explain structure and function. —EXPLAIN (*v.*) ↑ APPARENT

AM046 ordinary (*adj.*) Describes an object which has not been especially made for a purpose, *i.e.* it is of general use and not made for a particular function, *e.g.* ***a*** an ordinary flask can be used for a variety of purposes, as distinct from a distillation flask, or a graduated flask, each of which is used for a special purpose; ***b*** an ordinary diet contains the foods usually available and eaten in a country, as distinct from a fatty diet, containing more fat, or a special diet, for a sick person. ↓ ELEMENTARY · ADVANCED ↑ SPECIAL (Ag) · STATEMENT

AM047 elementary (*adj.*) Describes elements of a study or subject. ↓ ADVANCED (Ag) ↑ ORDINARY

AM048 advanced (*adj.*) Describes a later stage of study or development than elementary or initial, *e.g.* ***a*** an advanced study of physics is at a stage much beyond an elementary stage; ***b*** an advanced stage of tuberculosis indicates a considerable development of the disease in an individual. ↑ ORDINARY · ELEMENTARY (Ag)

AM049 criterion (*n., pl.* **criteria**) A rule, principle, definition or standard used to test or to assess a statement, fact or object for placing it into a class, *e.g.* ***a*** the criteria for assessing the accuracy of a measurement (the measurement is classed as accurate, approximate, correct, inaccurate, etc.); ***b*** the criteria for classifying a word as a noun, verb, adjective, etc.; ***c*** the criteria for determining whether a substance functions as an acid; different criteria give rise to different classes of acids. ↓ CONVERSE · ORDER · REVERSE · OBJECTIVE · VICE VERSA · CONCRETE · LAW ↑ STATEMENT

AM050 converse (*n.*) A relation of actions or statements which are equal and opposite in all respects, *e.g.* ***a*** the relation between increase and decrease is a converse relation, so decrease is the converse of increase, as the actions are equal and opposite in all respects; ***b*** if the line AB is perpendicular to the line CD then the converse is true, *i.e.* the line CD is perpendicular to the line AB; ***c*** dehydration is the converse of hydration. —***converse*** (*adj.*) ↓ CONTRARY ↑ CRITERION

AM051 contrary (*n.*) The opposite, with an implied contradiction, *e.g.* it was originally believed by chemists that atoms were indivisible, according to Dalton's theory, but demonstration to the contrary was given by Rutherford in 1908 when he observed the disintegration of radioactive atoms □ *the toad's skin is not wet, but, on the contrary, it is dry* —***contrary*** (*adj.*) ↑ CONVERSE → CONTRADICT

AM052 order[1] (*n.*) **1** A state in which the units of a whole are arranged, form a pattern or sequence, or are associated according to one or more definite rules. The pattern or sequence can be either in space or in time. **2** A state of affairs in which every unit is in its proper place and performs its proper function, *e.g.* ***a*** the ions in an ionic crystal are arranged in a definite order, such as in a face-centred cube of sodium chloride, with definite rules defining the crystal structure; ***b*** the names of the chemical elements can be put in an alphabetical order; ***c*** the various stages in an organic preparation must be carried out in the correct order; ***d*** an engine that ceases working is said to be out of order, *i.e.* everything is not performing its proper function, but when functioning again is said to be in working order. —***ordered*** (*adj.*) ↓ DISORDER[3] · CONFUSION · CHAOS · PROBABILITY ↑ CRITERION

AM053 disorder[3] (*n.*) A lack of order in a system or an arrangement. Disorder can exist in varying degrees, *e.g.* ***a*** in the liquid state ions or molecules display less order than in the corresponding solid state, so the ions and molecules display a limited

disorder; ***b*** if some names in an alphabetical list are out of order, then a certain degree of disorder exists in the list □ *disorder of ions or molecules is brought about by melting a solid* ↑ ORDER[1]

AM054 confusion (*n.*) A state of being thrown into disorder, or in which it is not possible to distinguish order, *e.g.* in the absence of sufficient knowledge confusion exists in classifying a specimen as a butterfly or a moth. —***confuse*** (*v.*) ***confused*** (*adj.*) ↑ ORDER[1]

AM055 chaos (*n.*) A state in which there is no order at all, and no connection between any units of a whole; it is the extreme form of disorder, *e.g.* in the gaseous state ions and molecules display no order at all; they are in a state of chaos. —***chaotic*** (*adj.*) ↑ ORDER[1]

AM056 probability (*n.*) The mathematical expression of chance. When a coin is thrown, there are two possible results and each result has an equal chance. The probability of one side of the coin appearing uppermost is 1 chance out of two chances; the probability is the fraction ½. ↑ ORDER[1]

AM057 reverse (*v.t.*) To make a process go back in the direction from which it came, *e.g.* ***a*** driving a car backwards is reversing the car; ***b*** making a chemical reaction proceed in the opposite direction is reversing the reaction, such as hydrolysis reverses the reaction of esterification. —***reverse*** (*n.*) ***reversible*** (*adj.*) ↑ CRITERION · CONVERSE

AM058 objective[1] (*adj.*) Describes a decision which is reached from empirical methods based on observations. The decision is thus independent of the observer's opinions, *e.g.* ***a*** all quantities are objective as their determination is based on empirical results; ***b*** all chemical tests are objective as they are carried out by experiment. —***objectivity*** (*n.*) ↓ SUBJECTIVE · RANDOM ↑ CRITERION

AM059 subjective (*adj.*) Describes a decision which is reached by an observer forming a personal opinion, *e.g.* ***a*** all qualities are subjective as their observation is based on the observer's opinion; ***b*** the smell of garlic is pleasant to some observers and unpleasant to other observers; this is a subjective opinion; ***c*** some properties of a substance (odour, colour) form a subjective test, other properties (density, boiling point, etc.) form objective tests. Identification usually relies on objective tests. ↑ OBJECTIVE[1]

AM060 random (*adj.*) Describes an action, event, process or state which follows no rule, and exhibits no order, *e.g.* ***a*** atoms of radioactive elements disintegrate in a random manner, *i.e.* there is no order in time at which the disintegrations occur; ***b*** a random choice of a name from a list has no greater chance of being taken than any other name; ***c*** natural selection of organisms is a random process; ***d*** when two dice are thrown the result is random, *i.e.* no combination has a greater chance of appearing than any other combination. A random event cannot be predicted. —***randomize*** (*v.*) ↑ OBJECTIVE[1] · CHAOS

AM061 vice versa (*adv.*)Introduces a converse relation without repeating the opposite statement, *e.g.* ***a*** iron reacts with steam and vice versa (steam reacts with iron); ***b*** a varying electric field produces a varying magnetic flux, and vice versa. ↑ CRITERION · CONVERSE

AM062 concrete (*adj.*) Describes that which consists of matter in contrast to that which describes the qualities and attributes of that matter, *e.g.* a bunsen burner is concrete but the hotness of its flame is an abstraction. ↓ REAL[1] · ABSTRACT[2] · IMAGINARY ↑ CRITERION

AM063 real[1] (*adj.*) **1** Describes anything that exists, but is not necessarily observable, nor is it necessarily material, *e.g.* ***a*** a real image formed by a lens is observable and does exist but is not material; ***b*** a beam of electrons can be demonstrated to have a real existence and can be considered to be material, but it is not directly observable. Contrast **concrete** and **real**: both describe existence, but a concrete object is always material, while a real object may not be material or observable. **2** (G.S.) Describes any inanimate object that is what it is stated to be, *e.g.* shoes made of real leather (as opposed to **imitation** leather). —***reality*** (*n.*) ↓ IMAGINARY (I) ↑ CONCRETE → IMITATION (I) · VIRTUAL (I)

AM064 abstract[2] (*adj.*) **1** Describes an entity which only exists in thought and has no concrete existence, *e.g.* beauty is abstract. **2** Describes a noun that is the name of a quality, attribute, or abstraction, *e.g.* redness and happiness are abstract nouns. ↑ CONCRETE (I)

AM065 imaginary (*adj.*) Describes something that is an invention of the mind, and has no real existence. An imaginary number is one involving the number $\sqrt{-1}$, usually represented by i; no real root can be extracted from this number. ↑ CONCRETE · REAL[1] (I) · ABSTRACT[2] (I)

AM066 law (*n.*) A law is an empirical generalization, either affirmative or conditional, that is accepted as true, *e.g.* ***a*** (affirmative statement) the extension of a spring is proportional to the load (Hooke's Law); ***b*** (conditional statement) for a given mass of gas *if* the temperature remains constant, *then* the volume of the gas is inversely proportional to the pressure (Boyle's Law). ↓ HYPOTHESIS · PRINCIPLE · PHYSICAL PRINCIPLES · THEORY · ANALOGY[1] · DEFINE · OBEY[2] · UNIVERSAL ↑ CRITERION

AM067 hypothesis (*n.*) A hypothesis is any sentence which has as a consequence at least one empirical generalization. In addition, a statement which contradicts the hypothesis cannot be proved after a definite number of observations. A hypothesis always contains theoretical terms, *e.g.* Avogadro's Hypothesis: the sentence 'Equal volumes of all gases at the same temperature and pressure contain the same number of

molecules', is the hypothesis. The theoretical term is molecule. The empirical generalization which is a consequence of the hypothesis is 32 g of oxygen, 28 g of nitrogen, 2 g of hydrogen, at standard temperature and pressure, each have a volume of 22.4 dm^3. The contradiction would be 'At the same temperature and pressure all gases contain different numbers of molecules'. This statement would require as many observations as there are gases at every possible temperature and pressure. Each of these observations would need to be confirmed by a number of different observers □ *to advance a hypothesis; to put forward a hypothesis* —***hypothetical*** (*adj.*) ↑ LAW

AM068 principle (*n.*) Principles are hypotheses accepted as suitable starting points for theoretical work, *e.g.* the principle of the conservation of energy. A principle turns into a law if what before could not be observed becomes observable by virtue of some advance in experimental technique. Avogadro's Hypothesis is now known as Avogadro's Principle as it is used as a starting point for theoretical work on gases □ *to formulate a principle* ↑ LAW

AM069 physical principles (*n.pl.*) The fundamental truths or propositions on which physics depends, *e.g.* the physical principle involved in the motor car is the principle of work ↑ LAW → CHEMICAL PRINCIPLES

AM070 theory (*n.*) **1** Theory is a structure in which each step depends on preceding steps. The structure can be stated in terms of concepts in relation. The whole structure rests upon observations and on theoretical assumptions. The advantages of scientific theory are that it can be used for the description, the classification, and the explanation of observed events. It can also be used for the prediction of future events. Take the Kinetic Theory of gases as an example. Step 1: observations are made on the pressure, volume, temperature, and mass of samples of different gases. These are the empirical foundations of the theory. Step 2: concepts of pressure, volume, temperature and mass are formulated. Step 3: the theoretical concept of the molecule is introduced and it is given theoretical properties. Step 4: concepts arising from Newton's Principles (momentum, force, energy) are introduced. These are related to the concepts of pressure, volume, and temperature. These relations lead to the final statement of the theory in mathematical terms. Step 5: $pV = \frac{1}{3}nmu^2$. Steps 2 to 5 are the structure of the theory. This statement can be used to explain: Boyle's Law, Charles' Law, Graham's Law of Diffusion, and the evaporation of liquids. It can be used to predict the velocities of molecules in specific gases at certain temperatures. **2** The process of investigation by logical or mathematical reasoning, rather than by experiment. Also the principles and reasoning associated with a practical process, *e.g.* the theory of an experiment to determine refractive index may depend on Snell's law and the principle of no-parallax. **3** An idea or thought about the reasons for or causes behind a phenomenon. In this sense *theory* is used in the same way as *hypothesis, e.g.* my theory is that all solids have an absorbed layer of gas on their surface □ in theory *the melting point of a solid changes with pressure but* in practice *this effect can often be neglected* —***theoretical*** (*adj.*) ***theoretically*** (*adv.*) ↑ LAW

AM071 analogy[1] (*n.*) If two processes are alike there is an analogy between them. Analogies are often used in science to help to understand difficult concepts. They do so by showing the similarities between the difficult concept and others that are more easily understood, *e.g.* the concept of collision between molecules of a gas is more easily understood if we think of it as similar to the collision of steel balls. An analogy is drawn between gas molecules and steel balls; this is an analogy of physical principles. An analogy can be drawn between the structure of an atom and that of the solar system; this is an analogy of structure. An analogy can be drawn between the way of working of a heart and that of a pump; this is an analogy of functions □ *an analogy is* drawn between *the earth rotating round the sun, and electrons rotating round a nucleus; an* analogy between *two processes; a* false analogy *of structure; a* limited analogy *between processes* ↓ MODEL · DEFINITION ↑ LAW

AM072 model (*n.*) A model is a physical device which represents an object. By examining the model we can find out facts about the object, *e.g.* a model of a bridge; a model of the solar system. Such models are called **representational models,** and they can be described as *true, adequate, distorted,* or *analogue* models.

A **true model** is one made accurately to a known scale (also known as a **scale model**), *e.g.* a model of a bridge in which the length, breadth, and thickness of each part in the model is exactly $^1/_{100}$ of the corresponding measurement in the bridge.

An **adequate model** is one in which only some of the measurements or characteristics are made to a scale, but sufficient detail is given for the purpose of the model.

A **distorted model** is one which uses different scales for different characteristics or measurements, *e.g.* a model of the solar system in which the distances between the planets is on one scale, but the spheres representing the planets are on a different scale because otherwise they would be too small to see.

An **analogue model** represents an analogy with the object. For example there is an analogy between the diffusion of molecules in a gas and the movement of a swarm of bees. The movement of the swarm of bees is the model; the diffusion of gas molecules is the object. An analogue model

need not be built, but only described.

A **theoretical model** describes an object or a system by using observables, the behaviour of which explains various properties shown by the object or system. The model is not built, only discussed. Usually the theoretical model uses an analogy of the object or system, *e.g.* ***a*** the Kinetic Theory of Gases uses a billiard ball model to describe the structure of a gas. A billiard ball is an observable, and the behaviour of the billiard balls explains the properties of the gas. In a theoretical model, the characteristics of the observables must be stated, *i.e.* that billiard balls have the characteristic of being perfectly elastic; ***b*** the passage of an electric current through metals is explained by the free-electron model of metals. Note the difference between a theoretical model and an analogue representational model. In a representational model, steel balls moving on a tray represent gas molecules, and no characteristics are stated. In the theoretical model the behaviour of the billiard balls describes the behaviour of the gas molecules. The *description* of the behaviour is more accurate than the *representation* of the behaviour of gas molecules. ↑ ANALOGY[1] · THEORY → OBSERVABLES

AM073 definition (*n.*) The statement by which a term is defined is called a definition, *e.g.* 'density is mass per unit volume' is a definition of density. ↑ ANALOGY[1]

AM074 define (*v.t.*) To state, in known terms, a clear description of a concept or the limits of a concept, and to give the new concept a specific term, which allows members of the group of scientists to discuss the concept without misunderstanding. Observation, disposition, and theoretical terms can be defined. Terms defined include: units of measurement; quantities; categories of substances, and properties and dispositions, *e.g.* ***a*** the unit of electric current is defined in terms of conductors, their arrangements in space, their dimensions, and of the force acting on them—the term, ampère, is given to the concept of *a unit of electric current*; ***b*** work is a physical quantity, defined in terms of force and distance, both of which must be precisely known terms—the concept of the quantity is given the term *work*; ***c*** an element is a category of substance defined in terms of chemical observation, or atomic structure; ***d*** viability is a disposition of living organisms defined in observation terms; ***e*** density is a property defined in observation terms of mass and volume. —DEFINITION (*n.*) ***defined, definable*** (*adj.*) ↓ PREDICT · RECAPITULATE · PUT FORWARD · EXEMPLIFY · CONTRADICT · DISCREDIT ↑ LAW

AM075 predict (*v.t.*) To give a description of future events in which certain principles and conditions are assumed to be valid. If the principles and conditions are fulfilled then the event will follow, *e.g.* ***a*** it is possible to predict the effect of a given stress on an elastic solid—the principle involved is Hooke's Law, the conditions those which apply to elastic solids under stress; ***b*** it is possible to predict that monoclinic crystals of beta-sulphur will be deposited by a saturated solution of sulphur in toluene at 115°C. The principles involved are those relating to the formation of crystals. The relevant condition is that 115°C is above the transition point for alpha-sulphur to beta-sulphur. —***prediction*** (*n.*) ***predictable*** (*adj.*) ↑ DEFINE

AM076 recapitulate (*v.t.*) To repeat a statement or a process, step by step, *e.g.* ***a*** the teacher recapitulated the necessary steps for conducting the experiment after a preliminary discussion; ***b*** the embryo of a mammal recapitulates its history of evolution. ↑ DEFINE → RECAPITULATION THEORY

AM077 put forward (*v.t.*) To state a theory, opinion or proposal for discussion by others; such a theory, etc., is usually tentative, *e.g.* ***a*** a proposal of a third type of atomic particle, called a neutron, was put forward to explain the fact that a helium nucleus had a charge of +2 and a mass number of 4; ***b*** Heisenberg put forward the principle that the position and velocity of an electron could not both be stated accurately at a particular instant. ↑ DEFINE

AM078 exemplify (*v.t.*) To give examples to make clear a description, statement, or discussion, which is difficult to understand because it is too general in nature or not in a person's usual experience. To give examples which serve as a particular case, or a particular description of a point under discussion, *e.g.* the behaviour of the coloured manganate (VII) ion (MnO_4^-), when a crystal of potassium manganate (VII) is placed in a beaker of water, exemplifies the process of diffusion (the coloured manganate (VII) ion spreads slowly through the solution). ↑ DEFINE → ILLUSTRATE

AM079 contradict (*v.t.*) **1** To say that a statement is untrue, *e.g.* Lavoisier contradicted earlier chemical theories by asserting his theory of oxidation. **2** (Of facts or statements) to be contrary to a related set of facts, etc., *e.g.* the times taken for a sheet of paper and for a metal sphere to fall to the ground from the same height are different and this fact appears to contradict the statement that all bodies in the same place have the same acceleration due to gravity. ↑ DEFINE → CONTRARY

AM080 discredit (*v.t.*) To state, with or without evidence, that a theory is inadequate or invalid, *e.g.* the theory that the earth was the centre of the universe was discredited by Galileo using the evidence from Copernicus (Galileo showed from the evidence that the original theory was invalid). ↑ DEFINE

AM081 obey[2] (*v.t.*) To agree with a principle or follow a law. Substances or materials under test obey the law relating to relevant measurements when the observed results show significant agreement with values predicted from the relevant law, *e.g.*

an elastic solid obeys Hooke's law below the limit of proportionality. —***obedience*** (*n.*) ↑ LAW

AM082 universal (*adj.*) Describes a law or rule which is valid in all cases, *i.e.* there are no exceptions. A statement is universal if it has no exceptions. Contrast **universal** with **general**, which describes a statement true in most cases, but able to have exceptions. Universal also describes that which exists or occurs everywhere, *e.g.* gravitation is a universal force because it exists everywhere throughout the universe. The term also describes that which involves the whole of a category, *e.g.* universal indicator is used to test all the values in the class of pH values. —***universality*** (*n.*) ↓ VALID · AUTHENTIC · LIMITED[1] · INVALID · TENTATIVE · TAKEN TOO FAR ↑ LAW → SPECIAL · PARTICULAR · GENERAL

AM083 valid (*adj.*) Describes a statement, conclusion, result or experiment that is correct, accurate or in agreement with experience, *e.g.* a valid result of an experiment is a result without any significant error. —***validity*** (*n.*) ↑ UNIVERSAL → INVALID (Ag)

AM084 authentic (*adj.*) Describes a statement containing facts which are true and correct; the statement can be trusted and is reliable as a source of information for further work. —***authenticate*** (*v.*) ***authenticity*** (*n.*) ↑ UNIVERSAL → FICTITIOUS (I)

AM085 limited[1] (*adj.*) Describes the application of a law, rule, or theory, or the use of devices, within stated circumstances, *e.g.* ***a*** Boyle's Law is only applicable to ideal gases, *i.e.* Boyle's Law is limited to ideal gases; ***b*** the mercury thermometer is limited in use within a certain range of temperatures; ***c*** ammeters and voltmeters have a limited range (they can be used only for a certain range of measurement); ***d*** the Kinetic Theory is limited to ideal gases (it does not give true results for real gases). Note: **limits** are the conditions of **limitation**. —***limitation, limit*** (*n.*) ***limit*** (*v.*) ***limiting*** (*adj.*) ↑ UNIVERSAL (I) → PARTICULAR · SPECIAL

AM086 invalid (*adj.*) Describes a statement, conclusion, result or experiment against which objection can be made. The term implies that the statement, etc., is one which cannot be accepted in all circumstances. Compare the use of 'not valid', *e.g.* Boyle's Law is valid at normal and low pressures, but the Law is not valid at high pressures. ↑ UNIVERSAL · VALID (Ag)

AM087 tentative (*adj.*) Describes a statement or an arrangement which may be further modified if found not to be satisfactory or valid, *e.g.* ***a*** all hypotheses are tentative because they may ultimately be found to be unsatisfactory; Dalton's Atomic Theory (really a hypothesis) was tentative and later found to be unsatisfactory as it did not explain the existence of isotopes; ***b*** a tentative arrangement of the chemical elements was made by Mendeleef in 1879 and it has now been modified in the light of the present knowledge of atomic structure. ↑ UNIVERSAL

AM088 taken too far (*adj.*) **1** Describes a process continued beyond the point chosen, *e.g.* ***a*** in an experiment on the elasticity of a wire, if the experiment is continued beyond the elastic limit of the wire it has been taken too far; ***b*** in the preparation of ethanal (acetaldehyde) it is important that the oxidation is not taken too far, otherwise ethanoic (acetic) acid is formed. **2** Describes a discussion extended beyond the limit of scientific validity, *e.g.* when using the analogy of an electron as being a minute sphere carrying a negative electric charge, an attempt to find the radius of the electron is taking the analogy too far. ↑ UNIVERSAL

Measurement

AN001 sum (*n.*) The arithmetical addition of like quantities; the addition of two or more vectors, *e.g.* ***a*** the sum of 4 and 5, ***b*** the sum of the masses of the reactants; ***c*** the sum of two velocities; ***d*** the sum of a mathematical series □ *4 added to 5 makes 9, which is the sum of 4 and 5* ↓ TOTAL[3] · PRECISION · SCALE[1] · ZERO[2] · TOTAL[1] · PRECISE · IMPRECISE · QUANTITY

AN002 total[3] (*n.*) The sum of a number of items, *e.g.* ***a*** when the marks on an examination script are added the result is a total; ***b*** when a sample of the population of a habitat is taken, the observer can arrive at an estimate of the total. —***total*** (*v.*) TOTAL (*adj.*) ↑ SUM

AN003 precision (*n.*) **1** The quality of being precise Describes an instrument or a machine which has the smallest possible error in its readings, measurements or method of working, *e.g.* ***a*** a precision instrument: ***b*** a precision machine. ↓ ACCURACY · SIGNIFICANT FIGURES · APPROXIMATION ↑ SUM

AN004 accuracy (*n.*) The quality of being accurate. ↓ ACCURATE ↑ PRECISION

AN005 significant figures (*n.*) Figures which have meaning; the significance of figures can only be given accurately in all cases if the number is expressed in standard form. ↑ PRECISION

AN006 approximation (*n.*) **1** A value or a statement which is near enough to the true value or the exact statement for the purpose of the observer. **2** A process of using successive values, step by step, to obtain a result for a calculation which gets nearer and nearer to the correct result. Each value used in the calculation depends on the preceding

result. The final result is still approximate, but more accurate than any preceding result. ↑ PRECISION

AN007 scale[1] (*n.*) A set of steps rising from a low value to a high value. A numerical scale may be marked on either a straight or a curved line, with the distances between the markings depending on a mathematical rule □ *a rough scale; a linear scale; an exponential scale; a logarithmic scale* ↓ NOUGHT · ZERO[1] · MAGNITUDE · CORRECTION · LEVEL · ORIGIN[3] ↑ SUM → QUALITY · QUANTITY · UNIT

AN008 nought (*n.*) The name of the symbol '0' in a number, *e.g.* the middle figure of the number 102 is nought. ↑ SCALE[1]

AN009 zero[1] (*n.*) A point on any scale from which positive units are marked off or measured in one direction and negative units in the opposite direction. The symbol for zero is '0', and the name of this symbol is nought □ *to set an instrument at zero* —ZERO (*v.*) *zero* (*adj.*) ↑ SCALE[1] → ORIGIN

AN010 magnitude (*n.*) A point on a scale represented by a number or ratio, *e.g.* the ratio of a mass m_1 to a specified mass m_0 (m_1/m_0) is the magnitude of mass. If the specified mass is a kilogramme and the ratio is 2, then the measured mass is 2 kilogrammes, which is the magnitude of its mass. Using a Celsius scale of temperature, the boiling point of water is 100°C, on the thermodynamic scale of temperature it is 373·16 K. Magnitudes are represented by numbers, on suitable scales, for all quantities. **Magnitude of a star** The brightness of stars placed on a scale of brightness, *e.g.* star of the first magnitude includes the brightest star of all. The absolute magnitude of a star measures the comparative brightness as if all stars were at the same distance (10 parsecs) from the Earth. ↑ SCALE[1] → UNIT (H) · VALUE (H)

AN011 correction (*n.*) The alteration, adjustment or addition made to a measurement or statement to make it correct, *e.g.* the end correction to the length of a pipe to obtain the true value of the length of the resonating air column. ↑ SCALE[1]

AN012 level (*n.*) One of a series of specified stages at which the magnitude of a quantity has a fixed value for a definite purpose or under specified conditions, *e.g.* ***a*** a hotel has floors at different levels (the height of each floor from the ground floor has a fixed value and represents a stage in ascending height); ***b*** the extra-nuclear electrons of an atom have a series of energy levels (fixed values of energy) and the electron cannot have an energy value between levels; ***c*** the temperature must reach a certain level for a piece of magnesium to burn; ***d*** the temperature of oxygen must be reduced to a certain level before the gas can be liquified; ***e*** if the concentration of sugar in the blood falls below a certain level, the person becomes unconscious. ↑ SCALE[1]

AN013 origin[3] (*n.*) A point of reference in space from which any other point in space can be described. It is used in a limited way in mathematics as the point from which the magnitude of two variables can be measured in order to draw a graphical representation of their relation. ↑ SCALE[1]

AN014 zero[2] (*v.t.*) To adjust a pointer reading or a scale reading on an instrument before it is used so that the pointer or the reference mark is at a reading of zero (0), or at any other selected point on the scale for the purpose of the experiment or recording a reading. ↓ CORRECT[2] ↑ SUM

AN015 correct[2] (*v.t.*) **1** To remove errors so that a true measurement or result is obtained or a true statement is made, *e.g.* ***a*** to correct an experimental measurement of the pressure of a gas by adding the atmospheric pressure to give the true pressure of the gas; ***b*** a burette reading is corrected by taking away the zero reading. **2** To remove errors in statements or calculations. ↑ ZERO[2]

AN016 total[1] (*adj.*) **1** Describes a result obtained by addition or the sum of quantities, *e.g.* ***a*** the total pressure is the sum of the partial pressures; ***b*** the total mass of the reactants is equal to the total mass of the products; ***c*** the total effect of a number of non-parallel forces acting on a body is given by the resultant force (vectorial addition). **2** Describes being complete, leaving out nothing; the whole is comprised of separate individual objects or items, *e.g.* ***a*** a total eclipse; ***b*** the total population; ***c*** total internal reflection. ↓ ENTIRE[1] · PARTIAL(I) · COMPLETE ↑ SUM

AN017 entire[1] (*adj.*) Implies completeness or perfection of a whole from which nothing has been taken and to which nothing can be added, *e.g.* the entire community of a habitat (no individuals have been taken away and no individual can be added to the community, otherwise a different community is formed). Note: to distinguish between **total** and **entire:** ***a*** the total population implies the individuals are countable as a whole and are not interrelated, in contrast to the entire community where the individuals are interrelated; ***b*** the entire charge on a proof plane can be given to a hollow conductor; the total charge on the hollow conductor results from the transfer of several charges from the proof plane. ↓ PARTIAL (I) ↑ TOTAL[1]

AN018 partial (*adj.*) Describes an object, configuration or process, which is not complete in itself, *e.g.* ***a*** a partial eclipse of the moon —contrast *total eclipse;* ***b*** a bell-jar evacuated to a partial vacuum, *i.e.* not a complete vacuum; ***c*** ether and water are partially miscible, *i.e.* not miscible at all temperatures or in all proportions. ↑ TOTAL · COMPLETE (I)

AN019 complete (*adj.*) Describes an object, process, sequence, configuration or collection in which every part, event or item is present to make a whole. The focus is on all the individual parts, events or items being present, with none missing, *e.g.* the community of a beehive is complete when all the bees have returned. To contrast **com-**

plete and **entire**: the complete experiment for the determination of the coefficient of elasticity requires readings to be taken with both increasing and decreasing tensile forces and the entire experiment can be finished in three hours. —***completion*** (*n.*) ***complete*** (*v.*) ↑ TOTAL

AN020 precise (*adj.*) Describes a statement which is complete in all possible details, and without error. Note: to distinguish between **precise** and **exact**: the exact description of a horse must give the properties which it must possess to be included in the species *Equus caballus*. This description does not distinguish between a horse and a pony. A precise description is needed to describe a horse or a pony by giving further details □ *a precise description* —PRECISION (*n.*) ↓ ACCURATE · EXACT · CORRECT[1] · APPROXIMATE · ACCEPTABLE · FINE[2] · COARSE[2] · IMPRECISE (Ag) ↑ SUM

AN021 accurate (*adj.*) **1** Describes a measurement which is as correct as the limits of measurement of an instrument make possible. An accurate measurement should give the limits of accuracy as well as the magnitude of a quantity. **2** An accurate statement contains the truth as far as is known, *e.g.* Boyle made an accurate statement of his Law, which was consistent with the knowledge of gases in the seventeenth century. Boyle's Law is now known not to be generally accurate. —ACCURACY (*n.*) ↓ APPROXIMATE (I) · EXACT (Sn) ↑ PRECISE (Sn) → INACCURATE (Ag)

AN022 exact (*adj.*) Describes a statement which is complete and accurate in the relevant detail, and without error, *e.g.* in Mendel's experiments on heredity, the theoretical ratio of phenotypes was 3:1, the exact results he obtained included a ratio of 787:277, *i.e.* 2·84:1. —***exactness*** (*n.*) ↓ CORRECT[1] · INEXACT (Ag) ↑ PRECISE · ACCURATE (Sn)

AN023 correct[1] (*adj.*) **1** Describes a measurement, number, statement, or result, which is in agreement with an accepted observation or statement, *e.g.* a determination of the acceleration due to gravity gives a result of 9·81 m s^{-2}; this is both a correct measurement of, and a correct result for, the acceleration, and when expressed in words is a correct statement, provided that it is accepted that the acceleration due to gravity at that particular place is 9·81 m s^{-2}. **2** Describes a calculation in which there are no errors, *e.g.* $2^3 = 8$ is a correct calculation. —***correctness, correction*** (*n.*) ***correct*** (*v.*) ↑ PRECISE

AN024 approximate (*adj.*) Being near a true value, or near enough for the purpose of measurement, *e.g.* ***a*** an exact measurement of a mass of a solid cannot be made for the purpose of making a solution; a mass is taken which is approximately correct, and then measured accurately; the purpose in this case is to make a solution, and the chosen mass must be near enough to the required needs for preparation of a suitable solution; ***b*** the velocity of light is (2·997925 ± 0·000003) × 10^8 m s^{-1} when measured accurately; approximate values can be taken for the velocity such as 2·998 × 10^8, or 3·0 × 10^8 m s^{-1}. These approximate values are correct to four and two figures respectively. ↑ PRECISE · ACCURATE (I)

AN025 acceptable (*adj.*) Able to be accepted or received; results are acceptable if numerical values are between agreed limits of accuracy. There are acceptable standards of purity for analytical and pharmaceutical chemicals, stating the percentage of impurity. ↑ PRECISE

AN026 fine[2] (*adj.*) Very sensitive or accurate, *e.g.* the fine adjustment of a microscope is used to focus the instrument accurately after the approximate focus has been found. —***fineness*** (*n.*) ↓ COARSE[2] (Ag) ↑ PRECISE → SENSITIVE

AN027 coarse[2] (*adj.*) Not very sensitive or accurate, *e.g.* a coarse adjustment on a microscope is a knob used to find the approximate focus. —***coarseness*** (*n.*) ↑ PRECISE · FINE[2] (Ag) → SENSITIVE

AN028 imprecise (*adj.*) Describes a statement which does not give all details, and can contain errors, *e.g.* an imprecise description of a gas may omit its colour or density or may give these facts incorrectly. The focus is on the lack of sufficient detail. —***imprecision*** (*n.*) ↓ INACCURATE (Sn) · INEXACT (Sn) ↑ SUM · PRECISE (Ag) → DETAIL

AN029 inaccurate (*adj.*) **1** Describes a measurement which is not correct because the instrument used for measurement is not giving a true reading, because the observer reads the instrument incorrectly, or because the instrument is not capable of reading to a required degree of accuracy, *e.g.* a determination of the speed of sound by timing an echo with a stop watch gives an inaccurate result. **2** Describes a statement which can be shown to be not true, *e.g.* Boyle's Law is now known to be an inaccurate statement for all conditions experienced by a gas. —***inaccuracy*** (*n.*) ↑ IMPRECISE (Sn) · ACCURATE (Ag)

AN030 inexact (*adj.*) Describes a number which is not exact, *e.g.* in Mendel's experiments an inexact value of the ratio of phenotypes was 3:1; although an inexact value was used, it was taken as an acceptable approximation. ↑ IMPRECISE (Sn) · EXACT (I)

AN031 quantity (*n.*) **1** Any measurement of matter or radiation, either direct or indirect, is a quantity. Examples of quantities are: mass, length, time, velocity, electric current, latent heat, angle of incidence, magnetic flux, coefficient of expansion, atomic number, wavelength, intensity of sound, amount of substance, and number. Some quantities are measured in units, other quantities are numbers, *e.g.* length is measured in metres, relative density is a number. **2** A measure of matter that does not give the units of measurement. Quantity cannot be used with countables, *e.g.* a

quantity of water; this could be measured by any of the quantities of mass, volume, or amount of substance. The term quantity must not be used where mass, or volume, is needed in the context □ *a small quantity; an exact quantity; an unspecified quantity; equal quantities; a large quantity; a specified quantity; a given quantity; a measured quantity; a variable quantity* **—quantify** (*v.*) QUANTITATIVE (*adj.*) ↓ FUNDAMENTAL QUANTITIES · BASIC QUANTITIES · DERIVED QUANTITIES · AMOUNT (Sn) · INCREASE[3] · VARIATION[1] · SPECIFIC[2] · CONVENTION · READING · TRACE[1] ↑ SUM

AN032 fundamental quantities (*n.pl.*) These are mass, length and time. All other physical quantities can be related to these three fundamental quantities. In the physical world, we have no choice over these quantities. ↑ QUANTITY

AN033 basic quantities (*n.pl.*) These are chosen quantities which are taken as independent measurements. In SI units the basic quantities are electric current, temperature, amount of substance, and luminous intensity. ↑ QUANTITY → SI UNIT

AN034 derived quantities (*n.pl.*) These quantities are measured in terms of the fundamental and basic quantities, *e.g.* density, velocity, force and resistance are derived quantities. ↑ QUANTITY

AN035 amount (*n.*) An unstated mass or volume of a solid or a liquid. The term cannot be used with countables and must not be used as a synonym for **mass** or **volume** or **number of**. The **amount of substance** is a physical quantity which is proportional to the number of specified particles of the substance. The particles include molecules, atoms, ions, radicals, electrons, photons, or any specified group of such particles. The amount of a substance is usually measured in moles; it is not the same as the mass of a substance, *e.g.* 1 mole of water molecules has a mass of 18 g, 2 moles a mass of 36 g. 1 mole of oxygen molecules has a mass of 32 g, ½ mole a mass of 16 g. ↓ UNIT · VALUE · RATIO · PROPORTION ↑ QUANTITY (Sn)

AN036 unit (*n.*) A well-defined, unvarying, reproducible, and universally available value of a quantity is accepted as a unit of that quantity. Units are usually agreed internationally. The ratio of any other value of the quantity to the accepted unit value is the magnitude of the quantity. For instance, there is a block of metal agreed as the international prototype of the kilogram; it is an unvarying universally available value of the quantity, **mass**. The magnitude of all other masses is measured as the ratio of their masses to the unit mass. □ *a system of units* ↑ AMOUNT → MAGNITUDE

AN037 value (*n.*) The numerical part of a measurement of a quantity, *e.g.* 6·3 metres is a measurement of the quantity, length; the metre is the unit of measurement and 6·3 is the numerical value. Temperatures of 30°C and 86°F each have different numerical values and different units, but both have the same magnitude. The magnitude of some quantities, *e.g.* relative density, is measured by a value only as the quantity has no units □ *measure the solubility at two intermediate values between 50°C and 100°C; the recommended values of physical constants include the mass of the electron* **—evaluate** (*v.*) ↑ AMOUNT → RANGE

AN038 ratio (*n.*) The ratio of two quantities is the fraction obtained by dividing the first quantity by the second quantity and then simplifying the fraction, *e.g.* ***a*** the ratio of 56 g to 48 g is $\frac{56}{48} = \frac{7}{6}$, written as 7:6; ***b*** the ratio of 25 m to 65 m is 5 : 13. ↑ AMOUNT

AN039 proportion (*n.*) Proportion is a continued ratio, *e.g.* 4:3 = 16:12 = 20:15, are in proportion. ↑ AMOUNT

AN040 increase[3] (*n.*) The difference in mass, length, area, volume, time, rate, number, amount or magnitude before and after these quantities have increased, *e.g.* the length is increased from 3 m to 5 m; the increase is 2 m □ *there is an increase in length; the increase in area is 2 m²; the number of cases of malaria is on the increase; there was an increase of 30 cases last week* ↓ INCREMENT · DECREASE[3] (Cn) · DECREMENT · NOTHING · EXCESS[1] · SOMETHING ↑ QUANTITY

AN041 increment (*n.*) A definite, controlled or finite increase in a number, or in the magnitude of a variable quantity, or of its dependent variable. An increment is generally small in relation to the number or magnitude under observation; it also forms a series of regular additions, *e.g.* ***a*** the angle of incidence is increased in increments of 5°; ***b*** the mass is increased by equal increments from 10 g to 100 g. ↓ DECREMENT (Cn) ↑ INCREASE[3]

AN042 decrease[3] (*n.*) The difference in mass, length, area, volume, time, rate, number, amount, or magnitude, before and after these quantities have decreased, *e.g.* the length is decreased from 5 m to 3 m; the decrease is 2 m □ *there is a decrease in length; the decrease in area is 2 m²; the number of cases of malaria is on the decrease; there was a decrease of 20 cases last week* ↑ INCREASE[3] (Cn)

AN043 decrement (*n.*) A definite, controlled, or finite decrease in a number, or in the magnitude of a variable quantity or of its dependent variable. A decrement is usually small in relation to the number or magnitude under observation; it can also form a series of regular subtractions, *e.g.* ***a*** the potential difference is decreased by decrements of 2 V; ***b*** regular decrements in the length of a pendulum produce diminishing decrements in the period of oscillation. ↑ INCREMENT (Cn) · INCREASE[3]

AN044 nothing (*n.*) If there is no perceptible matter or radiation at a particular place, there is nothing at that place, *e.g.* a flask which is empty contains air; when the air is pumped out there is nothing in the flask. (In general speech if the flask contains

only air it is described as having nothing in it) □ *the oscillations die away to nothing* ↓ SOMETHING (I) ↑ INCREASE[3] → NIL · NULL · ZERO[1]

AN045 excess[1] (*n.*) The amount beyond a limit or beyond what is needed, *e.g.* ***a*** a speed of 70 km h^{-1} is 20 km h^{-1} **in excess** of a speed limit of 50 km h^{-1}; ***b*** in order to be certain of dissolving 10 g of magnesium an excess of hydrochloric acid is used. ↑ INCREASE[3]

AN046 something (*n.*) A term that can be used in place of an object, configuration, collection, process, or sequence, when the object has an indefinite nature or has not been identified, *e.g.* ***a*** put something in the distillation flask to stop the liquid boiling violently; ***b*** there is something affecting the compass reading; ***c*** the animal is carrying something in its mouth. ↑ INCREASE[3]

AN047 variation[1] (*n.*) **1** The extent by which a quantity or a condition is varied or changed by an observer, *e.g.* ***a*** a variation in the pressure on a gas changes its volume; ***b*** an observer varies the resistance in an electrical circuit in order to produce a variation in the current flowing in the circuit, the e.m.f. being constant; ***c*** an observer can make a variation in the rate of reaction by changing the temperature at which the reaction takes place. **2** The extent to which natural phenomena vary, *e.g.* ***a*** the daily variation in temperature can affect the growth of plants; ***b*** the variation of pH of the soil depends upon the nature of the rocks from which the soil was formed.—***variable*** (*n.,adj.*) ***vary*** (*v.*) ↓ FLUCTUATION · ALTERATION · RATE ↑ QUANTITY

AN048 fluctuation (*n.*) One of a number of uneven and irregular variations above and below an expected value of a physical quantity as measured by an instrument. The fluctuations are usually between certain limits. The potential difference between the terminals of a mains supply of electric current may show fluctuations as the demand for current increases and decreases □ *violent fluctuations are between wide limits; wild fluctuations are between wide limits and of frequent occurrence; rapid fluctuations are of frequent occurrence; minor fluctuations are small and may be neglected; a fluctuation in voltage; to show fluctuations* —***fluctuate*** (*v.*) ***fluctuating*** (*adj.*) ↑ VARIATION[1]

AN049 alteration (*n.*) **1** The single event in which an object, condition, configuration, or process, is altered, *e.g.* the alteration of the pressure from 100 kPa to 120 kPa in an experiment. **2** The result of alteration, *e.g.* the alteration of the pressure was insufficient to produce an effect. ↑ VARIATION → ALTER[1,2]

AN050 rate (*n.*) A measurement of the change in a quantity in a stated period of time, *e.g.* ***a*** the rate of a chemical reaction is measured by the change in amount of the reactants in a given period of time; ***b*** the birth rate states the number of live births in a year; ***c*** the rate of descent of an aeroplane is measured in metres of height per second. ↑ VARIATION

AN051 reach (*v.t.*) To come to a place or to come to a definite value of a quantity, *e.g.* ***a*** to reach a town after travelling along a road; ***b*** to reach a critical stress when extending an elastic solid. ↓ EXCEED ↑ QUANTITY

AN052 exceed (*v.t.*) To increase above a certain value, or to go beyond certain conditions, *e.g.* ***a*** if the speed limit on a road is 50 km h^{-1} then any speed greater than 50 km h^{-1} exceeds the speed limit; ***b*** the upper limit of audibility is about 20 kHz (20000 cycles per second) and any frequency above 20 kHz exceeds the limit of audibility; ***c*** if the rating of an electrical fuse is exceeded, the fuse will melt. ↑ REACH

AN053 quantitative (*adj.*) Describing something that is concerned with the measurement of a quantity, *e.g.* ***a*** in the electrolysis of an electrolyte, quantitative measurements of mass and volume of the products can be made, quantitative measurements of electric current and potential difference can be made, and time can be recorded; ***b*** in an experiment on the germination of seeds, the percentage success of germination (by seed count) can be determined under different conditions (such as measured temperature, measured humidity); this is a quantitative experiment on germination; ***c*** the measurements of pressure and volume for a sample of gas is a quantitative experiment leading to the establishment of the mathematical relationship of Boyle's Law. ↓ MACROSCOPIC · MICROSCOPIC ↑ QUANTITY

AN054 macroscopic (*adj.*) **1** Describes objects observable by the unaided eye, in contrast to microscopic objects which are unobservable by the unaided eye. **2** Describes the properties of a substance in bulk, *i.e.* the usual properties of the substance, in contrast to the properties of the molecules or atoms of the substance. Thus the macroscopic properties of a gas include the temperature, pressure, volume and composition. ↓ MICROSCOPIC (Ag) ↑ QUANTITATIVE

AN055 microscopic (*adj.*) **1** Unobservable or imperceptible by the unaided eye; observable only by using a lens or microscope. **2** Describes the properties of a substance by the behaviour of its atoms, in contrast to the bulk properties. ↑ QUANTITATIVE · MACROSCOPIC (Ag)

AN056 specific[1] (*adj.*) Describes properties, characteristics, effects or processes that are chosen or special and thus different from other similar qualities, properties, etc., *e.g.* ***a*** a specific pressure, *i.e.* 760 mm of mercury, is chosen as the standard pressure for any gas; ***b*** all liquids have a specific temperature at which they freeze; *i.e.* a temperature that is special to a particular liquid. —***specifically*** (*adj.*) ↓ SIGNIFICANT · PERCEPTIBLE[2] · APPRECIABLE[1] · SPECIFIED · CERTAIN · GIVEN ↑ QUANTITY

AN057 significant (*adj.*) An event is

significant if it can be recognized as a sign that a change from the normal is taking place, *i.e.* the event has meaning, *e.g.* ***a*** there is a normal day-to-day variation in the atmospheric pressure, usually accepted as 3·5 cm above and below 76·0 cm of mercury. A variation of 8·0 cm below 76·0 cm is significant; it is a sign of a typhoon or hurricane, although the latter may not yet be apparent, but it is the reason for and the cause of the significant change in atmospheric pressure; ***b*** there is a slight variation of body temperature during the day; any other change of temperature is significant but only to a trained observer who can interpret the meaning. —***significance*** (*n.*) ↑ SPECIFIC[1] → VARIATION · VARIABLE

AN058 perceptible[2] (*adj.*) Able to be perceived or measured. A change which is barely perceptible is only just detectable. ↑ SPECIFIC[1] → IMPERCEPTIBLE (Ag)

AN059 appreciable[1] (*adj.*) A change which is large or important enough to be taken into account, *e.g.* an appreciable rise in temperature is a change important enough to be noticed as it may upset the course of a reaction. ↑ SPECIFIC[1] → NEGLIGIBLE (Ag)

AN060 specified (*adj.*) Describes the exact value of a quantity or describes the conditions for observations, *e.g.* ***a*** specified amounts of sulphur, charcoal and nitre, are mixed to form gunpowder; ***b*** 50 cm^3 is a specified volume of a liquid; ***c*** the change of volume of a gas with a change of pressure is measured at a specified temperature (a condition of the experiment). —***specify*** (*v.*) ***specification*** (*n.*) ↑ SPECIFIC[1] ↓ UNSPECIFIED (I)

AN061 certain (*adj.*) Describes a value or a condition in a similar manner to the adjective **specified** but without stating the value or the condition. The term implies that a value could be known, *e.g.* ***a*** at a certain temperature ice will melt to form water; the temperature depends upon the external pressure (the value of the temperature can be specified if the pressure is known); ***b*** at a certain stress a brass wire will stop behaving as an elastic solid and will behave as a plastic solid (the stress can be specified if the composition of the brass is known). ↑ SPECIFIC[1]

AN062 given (*adj.*) Describes a specified value or definite conditions for the purpose of calculation, prediction, or definition, *e.g.* for a given mass of gas, the temperature remaining constant, the pressure and volume are in inverse relation. ↑ SPECIFIC[1]

AN063 specific[2] (*adj.*) Used before the name of an extensive physical quantity to mean 'divided by mass', *e.g.* heat capacity is a property of an object; specific heat capacity is the heat capacity per unit mass and is a property of the substance of which the object is made. ↓ RANGING · CRITICAL · IMPERCEPTIBLE · NEGLIGIBLE · UNSPECIFIED ↑ QUANTITY

AN064 ranging (*part.*) Being able to have many different kinds, but the number of kinds being between two limits, *e.g.* ranging from dark red to light red, so no other colour can be used – dark red and light red being the limits of the range. ↑ SPECIFIC[2]

AN065 critical (*adj.*) Describes the value of a quantity at which an important or fundamental change in properties or conditions takes place, *e.g.* ***a*** the critical stress at which an elastic solid becomes plastic; ***b*** the critical temperature of a gas, above which the gas cannot be liquified by pressure alone. ↑ SPECIFIC[2]

AN066 imperceptible (*adj.*) Describes a change in a quantity or a quality that cannot be detected by an observer, *e.g.* when using an ammeter measuring up to 1 ampere, a change in current of 1 milliampere produces an imperceptible change in the reading of the instrument, *i.e.* the observer cannot perceive the change in reading. —***imperceptibility*** (*n.*) ↑ SPECIFIC[2] · PERCEPTIBLE[2] (Ag)

AN067 negligible (*adj.*) Describes a change in a quantity, usually a very small change, which will not be needed in a calculation, or in the development of a theory, *e.g.* when measuring the resistance of a resistor, the current passing through the resistor heats it, and then alters the resistance (which increases with temperature) but for most measurements the change in resistance is negligible, *i.e.* so small it does not affect the measurement. ↑ SPECIFIC[2]

AN068 unspecified (*adj.*) Describes a quantity for which no value is given or a condition about which no information is given, *e.g. sulphur, charcoal and nitre are the constituents of gunpowder* is a statement about unspecified quantities of each substance. ↑ SPECIFIC[2]

AN069 convention (*n.*) An arbitrary and constantly observed usage, *e.g.* ***a*** an electric current is thought of as flowing from positive to negative (an arbitrary choice of direction, observed in rules) although electrons travel from negative to positive; ***b*** positive electrical terminals are marked with red and negative ones with black; ***c*** the letters Na are by convention the symbol for sodium □ *by convention, the standard electrode potential is always measured at 25°C* —***conventional*** (*adj.*) ↓ SYMBOL · STANDARD[1] · CONSISTENCY[1] · ALTERNATIVE · STANDARDIZE · INVARIABLE · ARBITRARY · VARIABLE[2] ↑ QUANTITY → RULE (Sn)

AN070 symbol (*n.*) A letter or character that stands for a quantity, unit of measurement, mathematical operation, piece of scientific apparatus, a chemical element, etc., *e.g.* ***a*** *m* stands for mass, ***b*** kg stands for kilogramme; ***c*** × stands for multiply; ***d*** ⊣⊢ stands for an electric cell; ***e*** Na stands for a sodium atom or a mole of sodium atoms; ***f*** ♂ stands for a male individual. ↑ CONVENTION

AN071 standard[1] (*n.*) An object or substance chosen to provide the unit of measurement for a physical quantity, *e.g.* ***a*** the standard of mass is a piece of platinum-iridium alloy, *i.e.* an object of mass 1 kg; ***b*** the standard of length is defined from the

wavelength of a specified line in the spectrum of krypton-86 (a substance).

Absolute standards are standards chosen to provide the unit of measurement of a quantity, such as those described above.

Reference standards are compared with absolute standards, and used for checking accurate or precision instruments. Thus a standard metre length of platinum is checked against the absolute standard and used for calibrating measuring instruments. ↓ CONSTANT[1] · NORM · VARIABLE[1] · INDEPENDENT VARIABLE · DEPENDENT VARIABLE ↑ CONVENTION

AN072 constant[1] (*n.*) The numerical value of a physical quantity for a specified substance or radiation is known as a constant. For constants associated with specified substances or radiations the numerical value is dependent on the conditions of measurement and the value is stated for standard conditions, *e.g.* the density of water is 1·0 g cm^{-3} at 4°C. A **universal constant** is a constant that is independent of substance, radiation or conditions, *e.g.* ***a*** the mass of an electron; ***b*** the Faraday constant; ***c*** the Avogadro constant. ↓ CONSTANT[2] ↑ STANDARD[1]

AN073 norm (*n.*) An empirical generalization, concerning a variable, stated as a rule, or law, or given as an example; a norm is obtained from a series of observations on a natural occurrence, extending over a period of time. It is a measure of a quantity, or a quality, or it is a statement of behaviour, *e.g.* ***a*** the norm for body temperature of human beings is 37°C (many observations have indicated that a healthy person can be expected to have this temperature); ***b*** a norm of behaviour is a regular, usual pattern of behaviour. —***normality*** (*n.*) NORMAL (*adj.*) ↑ STANDARD[1]

AN074 variable[1] (*n.*) A quantity which can change in magnitude because of a change in a related quantity. The volume of a gas is a variable because it is changed by change in pressure applied to the gas, and the volume and pressure of a gas are related. (The relationship is stated in Boyle's Law.) Pressure is a variable as the pressure applied to the gas can be controlled. Both pressure and volume are quantities. ↑ STANDARD[1] (*n.*)

AN075 independent variable (*n.*) Two quantities related in magnitude to each other by a defined relationship (a law) may be considered to have an independent and a dependent variable. The independent variable is, **1** a variable that cannot be changed in magnitude by a change in the other quantity, *e.g.* in the relationship between the pressure and volume of a fixed mass of gas at a constant temperature, pressure causes a change in volume, but the volume cannot be changed to cause a change in pressure, so pressure is the independent variable; **2** the variable that is controlled in an experiment if both quantities can cause a change in the relationship, *e.g.* if in an experiment, different potential differences are applied to a resistor to change the current in the resistor, then the independent variable is considered to be the potential difference. By convention, the magnitude of the independent variable is shown on the x-axis in a graphical plot of the relationship. ↑ STANDARD[1]

AN076 dependent variable (*n.*) The variable which depends on the independent variable. Its magnitude is shown on the y-axis of a graphical plot. ↑ STANDARD[1]

AN077 consistency[1] (*n.*) The quality of being consistent, *e.g.* a set of experiments show consistency □ *the results have a high degree of consistency; the readings exhibit a low degree of consistency* ↓ INCONSISTENCY (Ag) ↑ CONVENTION

AN078 inconsistency (*n.*) The quality of not being consistent, *e.g.* ***a*** if the readings of a burette for the volume of an acid to neutralize a given volume of alkali differ by 0·4 cm^3 from each other, then the readings show an inconsistency; ***b*** if the readings for potential difference and current are inconsistent with the expected results from Ohm's Law, then the results show a degree of inconsistency. ↑ CONSISTENCY[1] (Ag)

AN079 alternative (*n.*) If there are two choices in any state of affairs, one is the alternative of the other, *e.g.* ***a*** there are two methods of preparing sulphuric acid industrially, the Contact Process and the Lead Chamber Process; these are alternatives for the production of the acid; ***b*** some coelenterates have alternative morphological structures, as they exist as polyps or medusae. —***alternative*** (*adj.*) ↓ POSITIVE[1] · NEGATIVE[1] ↑ CONVENTION

AN080 positive[1] (*adj.*) If alternatives have a polar relationship, *i.e.* one cannot exist without the other, then one alternative is described as positive and the other as negative. The description is a convention, *e.g.* ***a*** positive electric charge is only called positive by convention; ***b*** two conjugating hyphae of different strains of a fungus are called positive and negative. If one of the alternatives exhibits a tendency to donate, it is called positive, *e.g.* one of two conjugating bacteria which passes its chromatin thread into the other bacterium is called an F^+ (or positive) bacterium. ↓ NEGATIVE[1] (P) ↑ ALTERNATIVE

AN081 negative[1] (*adj.*) Describes the polar alternative of positive. ↑ ALTERNATIVE · POSITIVE[1] (P)

AN082 standardize (*v.t.*) **1** To measure a specific quantity against a standard, *e.g.* ***a*** the student standardized the concentration of an iodine solution against a solution of sodium thiosulphate (VI) of known standard; ***b*** a resistor is standardized, *i.e.* its resistance determined accurately, against a standard resistor using a metre bridge. **2** To cause to conform to, or to fit, an accepted standard, *e.g.* ***a*** there is a standard test for the amount of sugar in urine which standardizes the amount for the purposes of uroscopy; ***b*** the makers of scientific glassware have standardized the size of beakers at 100

cm^3, 250 cm^3, 600 cm^3, etc. ↓ NORMALIZE ↑ CONVENTION

AN083 normalize (*v.t.*) To make normal or to cause to function in a normal way, *e.g.* spectacles normalize vision for eyes suffering from defects, *i.e.* the spectacles give the person normal vision. ↑ STANDARDIZE

AN084 invariable (*adj.*) Describes a quantity which cannot change in magnitude under given circumstances, *e.g.* in experiments on a given mass of gas to determine the effect of temperature on pressure and volume, the mass is invariable. ↓ VARIABLE[2]

AN085 fixed (*adj.*) Describes one of a number of variables arbitrarily made unchanging under certain conditions for the purpose of a definition, a discussion or investigation. The variables for a gas are pressure, volume, temperature, and mass, so in the Gas Laws the variable of mass is fixed (made unchanging), which allows the relation between the other variables to be examined. Note that volume is inversely proportional to pressure at a *constant* temperature because the act of changing the pressure may change the temperature unless steps are taken to maintain temperature at a constant value throughout the experiment. —***fix*** (*v.*) ↓ CONSTANT (Sn) · STEADY (Sn) ↑ INVARIABLE → UNVARYING (Sn) · VARYING (I)

AN086 uniform (*adj.*) Describes a constant value of a quantity or a quality distributed over a space or area, or along a line, *e.g.* ***a*** a uniform concentration of a solute distributed over the whole of a solution (distribution over space); ***b*** a surface of uniform colour (the colour does not change over the whole area); ***c*** a particle with a uniform velocity (the velocity does not change along the line of motion of the particle). Note the difference between **uniform** and **constant**: a beaker of water kept at a constant temperature (the temperature of the water does not change); a beaker of water at a uniform temperature (the temperature at all parts of the water is the same). —***uniformity*** (*n.*) ↑ INVARIABLE → HOMOGENEOUS (H)

AN087 consistent (*adj.*) Agreeing within the limits of accepted numerical accuracy; agreeing within the limits of an accepted pattern of behaviour. Thus the reading obtained for the magnitude of the current flowing through a given resistor and the readings for the potential difference between the ends of the resistor are consistent with Ohm's Law if, when plotted on a suitable graph, they lie on a straight line within the limits of experimental accuracy (The readings are consistent with the requirements of a named law.) If the limit of accuracy of reading a burette is 0.05 cm^3, and three readings of a titration exercise do not differ by more than 0.05 cm^3, then the readings are consistent. (The readings are consistent with one another) ☐ *the results are* consistent with *Hooke's Law* —***inconsistent*** (*adj.*) ***consistency*** (*n.*) ↑ INVARIABLE → INCONSISTENCY (Ag) · ACCURATE

AN088 regular[2] (*adj.*) Describes occurrences with approximately equal differences in time or space between them, *e.g.* ***a*** an alternating current has a regular change in voltage (equal differences in time); ***b*** in the Contact Process for the manufacture of sulphuric acid, a regular supply of sulphur is needed (the sulphur is supplied every week or every month, or at any other fixed interval of time); ***c*** the ions in a crystal of sodium chloride are arranged in a regular pattern (corresponding differences in distance are identical). To contrast **regular** and **steady**: ***a*** a steady supply of sulphur for the Contact Process implies the same quantity at regular intervals; ***b*** an electric current may vary at regular intervals, but a steady current does not vary. —***regularity*** (*n.*) ↓ IRREGULAR ↑ INVARIABLE

AN089 irregular (*adj.*) Exhibiting no regular features in a pattern, either in time or in space. For instance, an amorphous substance has an irregular arrangement of atoms whereas a crystal has a regular arrangement. ↑ INVARIABLE · REGULAR[2] (I)

AN090 constant[2] (*adj.*) Describes an unchanging value of a physical quantity, *e.g.* ***a*** a water bath kept at a constant temperature by a thermostat; ***b*** the constant-volume air thermometer; ***c*** a generator maintaining a supply of electric current at a constant voltage. ↓ STEADY (Sn) ↑ INVARIABLE · UNIFORM (Cs) · FIXED (Sn) → VARYING (I)

AN091 steady (*adj.*) Reaching a certain value and remaining at that value, although with a disposition to vary; it implies the use of measuring instruments, *e.g.* ***a*** distillation takes place at a steady temperature; ***b*** a steady flow of gas takes place during diffusion; ***c*** a steady increase in pressure (the rate of increase remains constant). ↑ INVARIABLE · FIXED (Sn) · CONSTANT[2] (Sn) → FLUCTUATING (I)

AN092 average (*adj.*) Describes a measurement which is obtained by adding together a number of varying measurements and dividing by the number of measurements, *e.g.* if the temperature at noon on three successive days is 26°C, 28°C and 25°C, the average temperature for the three days is:

$$(26 + 28 + 25)/3 = 26{\cdot}3°C.$$

↑ INVARIABLE

AN093 arbitrary (*adj.*) Chosen for convenience or by decision with no relation to any theory, *e.g.* the upper and lower fixed points of the Celsius temperature scale are arbitrary because they were originally chosen for convenience, unlike the thermodynamic temperature scale which is based on Charles' Law; ***b*** the scale of electrode potentials has an arbitrary zero for hydrogen. ↓ STANDARD[2] · NORMAL[1] · ABNORMAL · SUBNORMAL · DEPENDENT · ABSOLUTE (An) · ADOPTED ↑ CONVENTION

AN094 standard[2] (*adj.*) **1** Describes the physical quantity for which there is a standard, *e.g.* standard metre. **2** An instrument or a piece of apparatus having a stated

measurement of a physical quantity, *e.g.* ***a*** volume (a standard pipette which delivers 25 cm^3 of liquid); ***b*** standard cell (a Weston Cadmium cell which has an e.m.f. of 1.0186 volts at 20°C); ***c*** standard resistor, *i.e.* a standard resistor of resistance 200 ohms at 20°C against which other resistances can be standardized. **3** Conditions chosen arbitrarily for the description of states and state functions, *e.g.* ***a*** the volume of a gas is stated as at 273 K and 760 mm (101 325 N m^{-2}); ***b*** the standard enthalpy of a compound $\Delta H^{\ominus}$ is given at 298 K and 1 atm pressure (101 325 N m^{-2}). ***—standardization, standard*** (*n.*) ***standardize*** (*v.*) ↑ ARBITRARY

AN095 normal[1] (*adj.*) Implies being of a norm, against which are examined all possible values of a variable. Those values which agree, or those patterns which conform, within accepted limits, are called normal, *e.g.* ***a*** the normal temperature of a human being is 37°C; ***b*** the normal behaviour of a wolf is to be a member of a pack (a pattern of behaviour); ***c*** the normal limits of audibility for a human being are 30 Hz for the lower limit, and between 20 kHz and 30 kHz for the upper limit (these limits vary for individuals). To contrast **normal, average,** and **standard**: the normal room temperature in a temperate climate is accepted as 18°C (an indefinite number of observations has led to this statement, and it is a value over which an observer has no control); the average temperature for the month of November in Cornwall was 10° C (a result obtained from the arithmetic average of a definite number of readings); the standard temperature for measuring certain chemical quantities such as enthalpy or entropy is 25°C (the value has been fixed arbitrarily) □ *above normal; below normal* ↓ ABNORMAL (An) · SUBNORMAL (An) ↑ ARBITRARY

AN096 abnormal (*adj.*) Describes appreciable departure from a norm, *e.g.* ***a*** a lone wolf exhibits abnormal behaviour (normal behaviour described as belonging to a pack); ***b*** gigantism and dwarfism are both abnormal conditions of growth (a pattern of normal growth can be stated). ***—abnormality*** (*n.*) ↑ NORMAL[1] (An) · ARBITRARY

AN097 subnormal (*adj.*) Describes a condition below normal where normality has a numerical value, *e.g.* ***a*** subnormal growth in a plant which has been starved of nutrients (a norm of height can be stated); ***b*** a subnormal level of glucose in the blood is a symptom of certain diseases (the normal level of glucose is defined within narrow limits of concentration). ↑ NORMAL[1] (An) · ARBITRARY

AN098 dependent (*adj.*) Describes a relationship between two variables. If A is dependent on B, then a change in B causes a change in A □ *the volume of a gas is* dependent on *its pressure* ↓ INDEPENDENT (I) ↑ ARBITRARY

AN099 absolute (*adj.*) **1** (Ph.) Describes a unit of measurement defined from the fundamental units of mass, length and time, or an experimental measurement which does not depend on the characteristics of the apparatus, *e.g.* ***a*** the absolute temperature scale which is defined from the thermodynamic considerations of the mass and volume of a gas does not depend on the physical properties of water as does the Celsius scale; ***b*** the absolute pressure of a gas is measured in units of force per unit area in relation to no pressure at all, whereas an apparatus usually measures the pressure above or below atmospheric pressure; ***c*** electric current can be measured by ammeters and galvanometers, but such measurements depend on the characteristics and inherent errors of the instruments, but an absolute measurement uses a current balance in which current is measured in terms of a known weight expressed in newtons, the absolute unit of force. **2** (Ch.) Describes a substance which is not mixed with other substances, *e.g.* absolute alcohol consists of ethanol only. ↑ ARBITRARY (An)

AN100 adopted (*adj.*) Describes systems of units, nomenclature, conventions and standards which have been accepted internationally, or by members of a group of scientists or engineers, and taken for scientific use by the group, *e.g.* the S.I. units (a coherent system) were proposed by an international body of scientists and have been adopted by a number of scientists at a national level. ***—adoption*** (*n.*) ***adopt*** (*v.*) ↑ ARBITRARY

AN101 variable[2] (*adj.*) Describes a quantity which can be changed in magnitude, or conditions which can be changed, *e.g.* ***a*** pressure is a variable quantity; ***b*** temperature is a variable condition; ***c*** the potential difference applied to a resistor is variable, as the p.d. can be varied. The changes are controlled by an observer. ***—variability*** (*n.*) ↓ INDEPENDENT (I) · VARYING (Sn) · FLUCTUATING · UNVARYING (An) ↑ CONVENTION

AN102 independent (*adj.*) Not dependent. *A* is independent of *B* if a change in *B* causes no change in *A* □ independent of *all other quantities.* ↑ VARIABLE[2] → DEPENDENT (I)

AN103 varying (*adj.*) Describes a quantity or condition which changes and cannot be controlled by an observer, *e.g.* ***a*** alternating current has a varying voltage (the voltage is not controlled by an observer); ***b*** the temperature of the atmosphere is a varying condition in biological experiments (atmospheric temperature cannot be controlled). Note the difference between **variable** and **varying**: the pressure in the tyres of a car is variable (air can be pumped in or let out); the atmospheric pressure was varying throughout the day (there is no control over it). ↓ UNVARYING (An) ↑ VARIABLE[2]

AN104 fluctuating (*adj.*) Describes a quantity or a reading which is varying above and below an average value. ↑ VARIABLE[2] → FLUCTUATION

AN105 unvarying (*adj.*) Describes a quantity, reading or condition which has the disposition to vary, but under observation does not vary, *e.g.* the atmospheric pressure was unvarying throughout the whole experiment. ↑ VARIABLE[2] · VARYING (An)

AN106 reading (*n.*) An observation of measurement on an instrument which possesses a numerical scale and a means of indicating a point on that scale, *e.g.* the thread of mercury indicates a point on a scale of temperature; that point is the thermometer reading □ *to take a reading; errors in reading; a series of readings* ↓ RESULT[1] · RESULT[2] · MEASUREMENT · DETERMINATION[1] · READ · EXTRAPOLATE · NIL ↑ CONVENTION → RECORD (Sn) · INSTRUMENT

AN107 result[1] (*n.*) The actual observed or measured change produced by a cause. To compare **effect** with **result:** ***a*** if copper is heated in air, it is oxidized; heating in air is the **cause**; the oxidation of copper is the observed *effect*; copper oxide is the actual *result*; ***b*** heating copper causes expansion and/or a change of state and/or oxidation (these are effects and the focus is on the agent, heat); ***c*** the expansion of copper is caused by heating it, or by applying a stretching force (heat, or a stretching force, is the cause; expansion is the effect; the measured increase in length is the result). ↑ READING

AN108 result[2] (*n.*) **1** The numerical value produced from the readings in a quantitative experiment. **2** The collection of observations and inferences obtained in a qualitative experiment. ↑ READING → INFERENCE · OBSERVATION · QUANTITATIVE · QUALITATIVE

AN109 measurement (*n.*) **1** The result of measuring, *e.g.* a measurement of a length. **2** The abstract process of measuring, *e.g.* the measurement of resistivity (no experimental detail is given and no particular material is mentioned). In this case measurement applies equally well to extensive and intensive properties. ↓ MEASURE[1] ↑ READING → PROPERTY

AN110 determination[1] (*n.*) The actual carrying out of an experiment to determine the value of a physical quantity, *e.g.* an experiment on the determination of the acceleration due to gravity. ↑ READING

AN111 read (*v.t.*) To observe the measurement of a quantity using an instrument Examples of instruments which are read are balances, hydrometers, thermometers, barometers, ammeters, voltmeters, clocks, lightmeters. An observer reads a thermometer to measure a temperature and **reads off** a particular temperature such as the boiling point of a liquid, and records that temperature □ *to* read off *a length on a rule; to* read off *an angle on a protractor* ↓ MEASURE[1] · RECORD · DETERMINE · TABULATE · VERIFY ↑ READING

AN112 measure[1] (*v.t.*) To find the value of a property by comparing its magnitude with a standard, *e.g.* ***a*** to measure the volume of an object by comparing its magnitude with the standard of measurement, *i.e.* the cubic metre; ***b*** to measure the electrical resistance of a metallic conductor by comparing its magnitude with the standard, *i.e.* the ohm. ↓ DETERMINE ↑ READ → CALIBRATE · VERIFY · DETECT

AN113 record (*v.t.*) To write down observations and measurements. ↑ READ → OBSERVATION

AN114 determine (*v.t.*) To find out precisely the value of a property by making a series of observations, *e.g.* ***a*** to determine precisely the density of a piece of copper by measuring its mass and its volume; ***b*** determine the resistivity of a specific material by measuring the resistance of a wire. **2** To be the cause of; to govern. If *A* depends on *B*, then the magnitude of *B* determines the magnitude of *A*, *e.g.* for a given mass of gas at a constant temperature, the volume of the gas is determined by its pressure. —***determination*** (*n.*) ↑ READ

AN115 tabulate (*v.t.*) To set out in a table, *e.g.* the results should be tabulated in four columns to show p, V, $1/V$ and pV for each set of readings. —***tabulation*** (*n.*) ***tabulated*** (*adj.*) ↑ READ

AN116 verify (*v.t.*) To make observations under experimental conditions which repeat the work of previous observers, in order to show that the previous observations or generalizations were true, *e.g.* ***a*** to make observations on current and potential difference with respect to a series of resistors and to show the results are consistent with Ohm's Law is to verify the law; ***b*** an experiment was conducted to verify the statement that chlorine is a more powerful oxidizing agent than bromine. Note that rules and laws can be verified, but hypotheses and theories cannot be verified. —***verification*** (*n.*) ↑ READ

AN117 extrapolate (*v.t.*) When a series of experimental results showing the relation between two variables is obtained, the upper and lower values of the independent variable fix the limits of the experimental observations. If a graphical relation is established between the two variables, it is assumed that the relation is true above and below the limits of observation. If a value, not observed experimentally, and lying outside the observed limits of the dependent or independent variable is required, it can be found from the graphical relation. To carry out this process of evaluation is to extrapolate, *e.g.* in an experiment, electric current is found to be proportional to potential difference across the ends of a resistor The limits of p.d. observed experimentally are 0·5 V to 50 V. If the current for a p.d. of 75 V has to be known, the value is extrapolated Note that extrapolation can yield an incorrect result, as the graphical or mathematical relation may not be true at very high or very low values of the independent variable ↓ INTERPOLATE (I) ↑ READING

AN118 interpolate (*v.t.*) When a series of

experimental results showing the relation between two variables is obtained, the upper and lower values of the independent variable fix the limits of the experimental observations. If a value, not observed experimentally, but lying between the observed limits of the dependent or independent variable is required, it can be found from the graphical relation established by the experimental results. To carry out this process of evaluation is to interpolate, *e.g.* in an experiment on Boyle's Law, the upper and lower limits of pressure are 200 cm and 30 cm of mercury. A graph of the results can be used to determine the volume of the gas at 160 cm if no experimental result at this pressure has been obtained. The magnitude of the volume is interpolated from the results. —***interpolation*** (*n.*) ↑ EXTRAPOLATE (I)

AN119 nil (*adj.*) Describes a physical quantity which has a value of nought, *e.g.* ***a*** if no current passes in an electric circuit, it is called a nil current. Contrast this with **negative**. If qualitative tests are made for the presence of arsenic as an impurity in a mineral, and no arsenic is found, it is a negative result, as opposed to a positive result when arsenic *is* found; ***b*** if a quantitative test is made on the level of radioactivity from a mineral and no radiation is detected, a nil result is recorded; ***c*** if there are no people admitted to hospital, a nil return is made □ *a nil value was recorded; a nil reading was obtained* ↓ NULL ↑ READING → NOUGHT

AN120 null (*adj.*) Describes a method of measurement in which the quantity being measured is balanced against a similar quantity so that the measuring instrument records a nil quantity, *e.g.* in a potentiometer the e.m.f. of an electric cell (the quantity being measured) is balanced against the e.m.f. of a standard electric cell (a similar quantity) so that a galvanometer records a nil current (a nil quantity) □ *a potentiometer is a null method of measurement* —***nullify*** (*v.*) ↑ NIL → NULL POINT · NULL DEFLECTION

AN121 trace[1] (*n.*) A very small amount; the term is often used of an impurity. ↓ EXUBERANT · PLENTY OF · ENOUGH · LACK OF ↑ QUANTITY → PURE

AN122 exuberant (*adj.*) Describes the process of growing vigorously; the result is luxuriant growth or abundant progeny. The focus is in the growth process, *e.g.* the exuberant growth of trees in tropical rain forests. —***exuberance*** (*n.*) ↓ PROLIFIC · LUXURIANT · LUSH · PROFUSE · EXCESSIVE · EXCEEDINGLY ↑ TRACE[1]

AN123 prolific (*adj.*) Describes the state of being able to reproduce abundant offspring, fruit, or spores, *e.g.* some birds are so prolific that the flocks become immense; the emphasis is on the number of progeny. ↑ EXUBERANT → FERTILE · PROLIFERATE · PROGENY

AN124 luxuriant (*adj.*) **1** Describes the state of a plant in which the vegetative organs are more developed than the reproductive organs, because of exuberant growth, *e.g.* the luxuriant growth in a tropical rain forest arises from the ample supply of nutrients and water. **2** Describes a thick growth of fur or hair on an animal, *e.g.* a male lion has a luxuriant mane (of hair) growing at the back of his head and neck. ↓ LUSH (Sn) ↑ EXUBERANT

AN125 lush (*adj.*) Describes luxuriant growth with the added implication of quality, *e.g.* in a lush growth of grass in a field, the grass is both luxuriant and succulent (the quality) and has reached perfection for the grazing of cattle. ↑ LUXURIANT (Sn) · EXUBERANT

AN126 profuse (*adj.*) Describes the state of being produced or given out in great abundance. The term implies that more is produced than is normal or necessary, *e.g.* ***a*** wind-pollinated flowers are profuse in their production of pollen (the pollen is abundant, only a small fraction is used for pollination, hence most of the quantity is wasted); ***b*** profuse sweating occurs in feverish patients. —***profusion*** (*n.*) ↓ ABUNDANT (Sn) ↑ EXUBERANT

AN127 excessive (*adj.*) Describes a quantity or process which is much greater than normal, and is undesirable or harmful, *e.g.* ***a*** an excessive electric current passed through an ammeter destroys the instrument. (If the ammeter measures 0 – 1 amperes, and a current of 10 amperes is passed through the ammeter, the current is excessive); ***b*** an excessive quantity of vitamin A is toxic; ***c*** exposure to excessive radiation from radioactive waves may cause leukaemia; ***d*** excessive rainfall may damage crops. ↓ ABUNDANT (Sn) ↑ EXUBERANT

AN128 exceedingly (*adv.*) To a great extent; extremely; used to modify adjectives which form gradable antonyms (coded Ag). Compare **excessively,** which implies too much or more than is wanted, *e.g.* there is an exceedingly high temperature in the sun (very high temperature); the temperature of a resistance may become excessively high if too much current passes, *i.e.* it becomes too high and may damage the resistor. ↑ EXUBERANT → EXCEED

AN129 plenty (of) More than is needed or required; more than usual, *e.g.* if there is plenty of water, a plant has its need supplied and there is some left over. The term can only be used attributively. ↓ AMPLE (Sn) · PLENTIFUL[1] (Sn) · ABUNDANT (Sn) · COPIOUS · DENSE[2] · ENOUGH (An) · LACK OF (I) ↑ TRACE[1]

AN130 ample (*adj.*) Describes the quantity of an uncountable, *e.g.* water, salt, courage, that supplies more than is needed or is required, *e.g.* ***a*** plants have ample water in tropical rain forests (more water is supplied as rain than is needed by plants, or required by a particular plant); ***b*** there are ample reserves of coal in North Europe to last for the next hundred years (coal is an uncountable, more is available than will be needed or required); ***c*** there is ample space for

setting up the apparatus (space is here an uncountable noun). The term can be used attributively and predicatively in all situations. ↓ ENOUGH (An) · ADEQUATE (An) · SUFFICIENT (An) ↑ PLENTY (OF) → INADEQUATE (I)

AN131 plentiful[1] (*adj.*) Describes the condition of material objects or substances greater in quantity than usual. The objects or substances have a potential use. The term is used predicatively with nouns or attributively with some quantifying adjectival phrases, *e.g.* **a** a plentiful supply of oxygen is available from a gas-cylinder (compared with other methods of obtaining oxygen which give only a limited supply, the cylinder gives a plentiful supply)—the oxygen is to be put to use; ***b*** carbon dioxide is formed when carbon burns in a plentiful supply of air; ***c*** wood is plentiful in Canada (it is put to use) □ *a plentiful supply of oxygen* ↓ SCARCE (An) ↑ PLENTY OF (Sn)

AN132 abundant (*adj.*) Describes the condition of being very plentiful in quantity. The term is used predicatively with nouns, or attributively with some quantifying adjectival phrases; it is not used with numbers. It implies distribution over an area, and when used predicatively has no implication of potential use, *e.g.* ***a*** in temperate climates, flowers are abundant in the Spring (very plentiful, widely distributed, no implied use); ***b*** oxygen is the most abundant of the elements (no implied use, with distribution); ***c*** some iron ores are comparatively abundant in Europe (the ores exist in plentiful quantities but are not necessarily mined) □ *an abundant supply* ***—abundance*** (*n.*) ***abundantly*** (*adv.*) · ↓ RARE (An) ↑ PLENTY OF · PROFUSE (Sn)

AN133 copious (*adj.*) Describes a plentiful flow of a fluid, measured in quantity and rate. The term can be used attributively and predicatively with nouns for processes indicating a fluid flow, attributively with some quantifying adjectival phrases, and with the term 'flow', *e.g.* ***a*** copious urination is observed in diabetics (noun of process); ***b*** a copious evolution of hydrogen is obtained when magnesium reacts with mineral acids; ***c*** a copious supply of drinking water (it flows in great quantity). ↓ SCANTY (An) ↑ PLENTY OF

AN134 dense[2] (*adj.*) (Of plants) growing very close together, and hence abundantly. The term also implies that it is not possible to see through the growth, *i.e.* it is difficult to penetrate, *e.g.* ***a*** a dense mass of shrubs hiding other vegetation; ***b*** the dense vegetation growing in a forest and preventing an easy passage through the forest. ***—density*** (*n.*) ***densely*** (*adv.*) ↑ PLENTY OF → THICK (Sn)

AN135 enough (*adj.*) Describes the quantity or quality that is required to supply a need, *e.g* a plant needs water; if it has enough water, its needs are supplied □ *the man has enough food; the quantity of food is enough* ↓ SUFFICIENT (Sn) · REQUIRED · ADEQUATE ↑ TRACE[1]

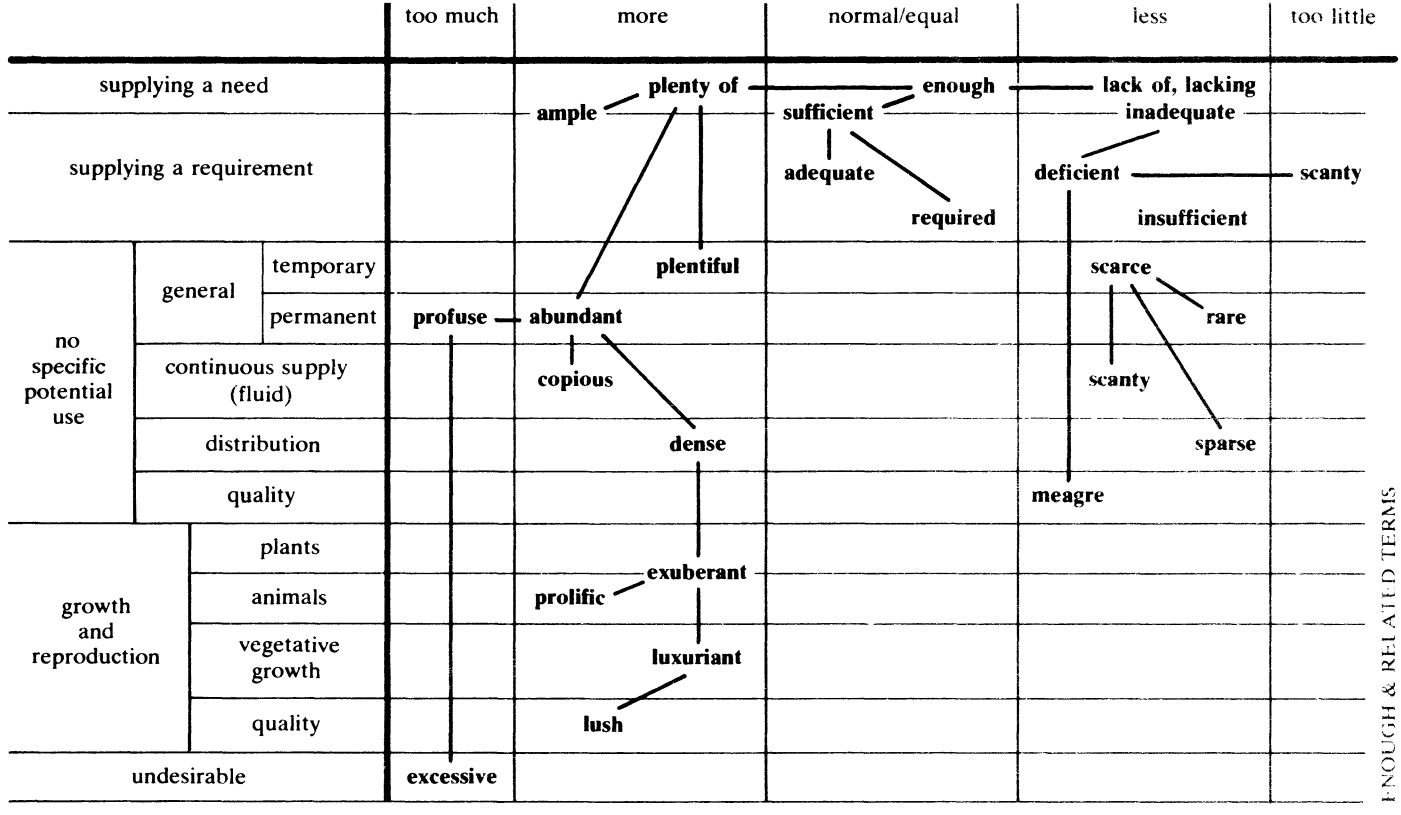
AN136 sufficient (*adj.*) Describes the quantity or quality needed. Sufficient and enough are almost identical in meaning but there are differences in the uses in sentences. Both adjectives are used predicatively, *e.g.* the water was sufficient (or enough) to dissolve the salt. When used attributively, both adjectives can be used to qualify nouns for objects, substances or concepts, *e.g.* there is sufficient (or enough) water to dissolve the salt. Enough can not be used to qualify nouns for quantities, such as 'amount', 'quantity', 'supply', 'flow', etc. Thus one can say 'there is a sufficient supply for my needs" but *not* *"there is an enough supply'. ***—sufficiency*** (*n.*) ***suffice*** (*v.*) ↓ ADEQUATE (Sn) · INSUFFICIENT (An) ↑ ENOUGH (Sn)

AN137 required (*adj.*) Describes a quantity or quality that is equal to a requirement. ↓ ADEQUATE ↑ ENOUGH

AN138 adequate (*adj.*) Describes a quantity or quality that is equal to a requirement. The actual quantity at the time of description may not be known, but is measurable against the requirement of the given situation, *e.g.* ***a*** the variable resistor is adjusted to give an adequate current to provide a full-scale deflection on the instrument (the current is exactly equal to that required); ***b*** the volume of water must be adequate just to dissolve the solid (neither too much, nor too little). Contrast **required** which has a similar meaning to adequate, but implies the quantity is known, *e.g.* ***a*** add an adequate volume of acid to neutralize the alkali (the volume of alkali is not stated, and so the volume of acid is unknown when making the statement); ***b*** add the required volume of acid to neutralize the alkali in the flask (the volume of alkali is now known, and hence the volume of acid will be specific). ***—adequacy*** (*n.*) ↓ DEFICIENT (Sn) · INADEQUATE (Sn) · INSUFFICIENT (Sn) ↑ ENOUGH · SUFFICIENT (Sn) · REQUIRED (Sn) · AMPLE (An)

AN139 lack (of) (*adj.*) Describes the quantity of a substance or the quality of an abstraction that is not enough to supply a need, *e.g.* if there is a lack of water, the plant does not have its need supplied. The phrase cannot be used predicatively □ *there is a lack of sunshine in cold weather; the lack of warmth prevents the plant from growing* ***—lack*** (*n.*) ***lack*** (*v.*) ↓ INADEQUATE (Sn) · DEFICIENT (Sn) · INSUFFICIENT (Sn) · SCANTY · SPARING · SCARCE · RARE · SPARSE · MEAGRE · TRACE[2] ↑ TRACE[1] · PLENTY OF (An) · AMPLE (An)

AN140 inadequate (*adj.*) Describes a quantity of a substance or a quality of an abstraction that is less than a need or a requirement. The need or requirement is known, or is obvious at the time of making the statement, *e.g.* ***a*** the volume of acid was inadequate to neutralize the alkali completely (it did not meet the requirement of the acid for the purpose); ***b*** the heat supply was


too much
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supplying a need
supplying a requirement
no specific potential use
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distribution
quality
growth and reproduction
plants
animals
vegetative growth
quality
undesirable
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rare
profuse
abundant
copious
scanty
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exuberant
prolific
luxuriant
lush
excessive

inadequate to maintain the liquid at its boiling point (a definite quantity of heat was required, and the supply was not equal to that quantity); ***c*** his knowledge of differential equations was inadequate for solving the problem (not equal to the required knowledge). —***inadequacy*** (*n.*) ↓ DEFICIENT (Sn) · INSUFFICIENT (Sn) · SCANTY · SCARCE · RARE · SPARSE · MEAGRE · TRACE[2] ↑ SUFFICIENT (An) · ADEQUATE (An) · LACK OF

AN141 deficient (*adj.*) Describes a material or abstraction that is lacking in quantity in some part of it, so that the whole does not meet a requirement, *e.g.* a diet deficient in iron can cause anaemia (the diet is the whole, iron is part of the diet, iron is lacking so that the diet does not meet nutritional requirements). Compare **deficient, inadequate**, and **insufficient**. A diet with insufficient iron can cause anaemia – it is a deficient diet. Note that insufficient is used to qualify the part missing; deficient qualifies the whole. Both inadequate and deficient describe something that does not meet the requirement. Deficient is used when one of the essential parts is missing, *e.g.* deficient food supply. Inadequate is more general, *e.g.* an inadequate food supply may lack necessary constituents, or it may lack total quantity □ *a diet deficient in calcium may lead to rickets* —DEFICIENCY (*n.*) ***deficit*** (*n.*) ↓ INSUFFICIENT (Sn) ↑ INADEQUATE (Sn) · LACK OF

AN142 insufficient (*adj.*) Describes a quantity of a substance or the quality of a theoretical concept that does not meet a requirement; it qualifies the part that is lacking, not the whole, *e.g.* there is insufficient protein in the diet (the requirement is not met, and the *part* of the diet that is lacking is described, not the diet). The term can be used as a true adjective, and qualifies a noun from a material object. —***insufficiency*** (*n.*) ↑ AMPLE (An) · SUFFICIENT (An) · LACK OF · INADEQUATE (Sn) · DEFICIENT (Sn)

AN143 scanty (*adj.*) Describes the condition in which the quantity of material objects or substances, or an extent, or a flow of a fluid, is not sufficient for a requirement, or is below the average measure. The term is used predicatively or attributively with a quantifying phrase, *e.g.* ***a*** the yield of crystals was scanty (insufficient for a requirement); ***b*** a scanty supply of food prevents an increase in an animal population (insufficient quantity); ***c*** scanty flow of urine is a symptom of malaria (flow of fluid below average). —***scantiness*** (*n.*) ***scantily*** (*adv.*) ↑ LACK OF · DEFICIENT · COPIOUS (An)

AN144 sparing (*adj.*) Describes an action or a process using matter or energy in small quantities only; the term is more frequently used as the adverb, **sparingly**, *e.g.* silver nitrate solution is used sparingly in chemical tests owing to its high cost. To contrast **sparing** and **scanty**: although the Solvay process is sparing in its use of ammonia, owing to ammonia being recycled in the process, a scanty supply of ammonia from the manufacturer could hinder the operation of the process □ *the Solway process is sparing of ammonia; the process uses ammonia sparingly;* be sparing with *the use of ammonia in cleaning clothes* ↑ LACK OF

AN145 scarce (*adj.*) Describes the condition in which material objects are difficult to obtain; the shortage is often a temporary one. The term is used predicatively, *e.g.* bananas are scarce this month (a temporary shortage). Contrast **rare** and **limited**; *rare* is used when the condition is permanent and usually occurs naturally; *limited* is used when circumstances or conditions place a limit on the number or quantity of objects, organisms or substances; *scarce* when the focus is on the temporary nature of the condition. —***scarcity, scarceness*** (*n.*) ↑ LACK OF · PLENTIFUL (An)

AN146 rare (*adj.*) Describes the condition of being uncommon or small in quantity. The term is used attributively or predicatively but is not used with quantifying adjectival phrases; thus one can say 'elephants are rare', but *not* *'the number of elephants is rare'. It implies limited distribution over a wide area; it also describes an occurrence which happens very infrequently, *e.g.* ***a*** reptiles are rare in cold climates (there are few of them, and the few are distributed over a wide area); ***b*** xenon is a rare gas in the atmosphere (only a small quantity is distributed over the whole atmosphere); ***c*** it is rare for an electric light bulb to burn out in less than 50 hours (a very infrequent occurrence). —***rarity, rareness*** (*n.*) ***rarefy*** (*v.*) ↑ LACK OF · ABUNDANT (An) · PROFUSE (An)

AN147 sparse (*adj.*) Describes a distribution of objects widely scattered over an area; it does not imply that the number or quantity is insufficient or inadequate, *e.g.* ***a*** a skin covered in sparse hair (hair is distributed over the skin, and the quantity in any one area is less than would be expected); ***b*** a sparse distribution of carnivores over a given territory is to be expected (the area is small, the condition is neither temporary nor permanent, there are few carnivores, and the focus is on the distribution over the area). —***sparseness*** (*n.*) ↑ LACK OF · DEFICIENT · SCANTY (Sn) · RARE (Sn) · DENSE (An) · ABUNDANT (An) → LIMITED (Sn)

AN148 meagre (*adj.*) Describes an absence of quality necessary for the completeness of a material object or idea, *e.g.* a meagre diet does not satisfy the requirements of an individual (the diet may be sufficient but lacking in quality, *e.g.* the quantity of protein may be sufficient, but the quality of protein may be poor, such as too much vegetable protein). ↑ LACK OF

AN149 trace[2] (*adj.*) Occurring in very small amounts, *e.g.* a trace element is a chemical element present in very small quantities (necessary in foodstuffs for animals or in soil for plant growth). ↑ LACK OF

Relationship

AP001 relation (*n.*) A connection between qualities, phenomena and ideas. When *A* and *B* are related there is a relation between them, *e.g.* there is a relation between the volume of a fixed mass of gas and its pressure at a constant temperature □ *a* relation between *two phenomena* ↓ RELATIONSHIP · CORRESPONDENCE · RELATE · COMPARE · RELATIVE · DIFFERENT · ALIKE · IDENTITY → QUANTITY

AP002 relationship (*n.*) When there is a relation between *A* and *B*, a relationship exists between them. The relationship is the type of relation, *e.g.* the relationship between the volume and pressure of a fixed mass of gas, at a constant temperature, is an inverse proportionality. There is a numerical relationship between *A* and *B* when the relation between *A* and *B* can be stated in numbers, *e.g.* if the relation between *A* and *B* is that *A* is doubled when *B* is doubled, then the relationship between *A* and *B* is one of direct proportionality. ↓ CONTRAST[1] · REFERENCE · POLE[1] ↑ RELATION

AP003 contrast[1] (*n.*) **1** A statement of differences between two objects, substances, organisms or radiations; there are usually some features in common when a contrast is made. **2** The existence of differences between two objects, substances, organisms or radiations, *e.g.* ***a*** the contrast of light and shade; ***b*** the range of γ-rays is in marked contrast to the range of α-rays, *i.e.* there is a great difference between the ranges of the two types of ray □ *there is a sharp contrast between fluorine and the remainder of the halogens; there is a marked contrast between the locomotion of a snake and of all other reptiles* ↓ COMPARE ↑ RELATIONSHIP

AP004 reference (*n.*) **1** A statement, generalization or state of affairs to which a person is referred, *e.g.* ***a*** the description of the properties of iodine contained a reference to the properties of chlorine; ***b*** a description of the digestive system of herbivores usually contains a reference to the bacterial decomposition of cellulose. **2** Used in the expression **with reference to.** Attention is directed to the main subject under discussion, or to be used in discussion, *e.g.* ***a*** with reference to the process of sulphonation, it is suggested that there are two possible mechanisms; ***b*** explain the ability of metals to conduct electric current with reference to the mobility of electrons; ***c*** explain the mechanism of respiration with especial reference to the role of diffusion. ↑ RELATIONSHIP → REFER

AP005 pole[1] (*n.*) One of a pair of opposites which cannot be separated from each other, *e.g.* ***a*** the negative and positive poles of a battery, cell, etc.; ***b*** the N and S poles of the earth or of a magnet. —POLARITY (*n.*) POLAR (*adj.*) ↑ RELATIONSHIP

AP006 correspondence (*n.*) The state of corresponding, *e.g.* ***a*** there is correspondence of function between the gill of a fish and the lung of a mammal; ***b*** there is no correspondence between the skeleton of an insect and the skeleton of a vertebrate □ *there is* correspondence between *the two structures* —***correspond*** (*v.*) ↓ CONGRUITY · CONGRUENCE · CONFORMITY · ACCORDANCE · AGREEMENT ↑ RELATION → CORRESPOND

AP007 congruity (*n.*) A relationship of one-to-one correspondence in the characteristics, properties, qualities or features of an object or concept under discussion; it is not a correspondence in all such detail, *e.g.* two triangles of identical shape can show congruity, but if one is red and one is blue they are not identical. —***congruent*** (*adj.*) ↑ CORRESPONDENCE

AP008 congruence (*n.*) An alternative term for congruity, but usually reserved for geometrical congruity, *i.e.* identical geometric shape. ↑ CORRESPONDENCE

AP009 conformity (*n.*) Agreement with the predictions of a given law, principle or pattern of behaviour, *e.g.* ***a*** the results obtained for the extension of a spring under a load are in conformity with Hooke's Law, as long as the elastic limit is not exceeded; ***b*** real gases do not conform to Boyle's Law, *i.e.* when measurements are taken of volume and pressure, the results are not in agreement with Boyle's Law—a real gas does not behave in accordance with Boyle's Law □ *the results are in conformity with Archimedes' Principle* —***conform*** (*v.*) ↑ CORRESPONDENCE

AP010 accordance (*n.*) The state of following an accepted or defined course of behaviour, *e.g.* ***a*** in accordance with the instructions, the solute is added to hot water (an accepted course of behaviour); ***b*** a permanent gas at low pressure expands in accordance with Boyle's Law (a defined course of behaviour) □ *in accordance with Ohm's Law, the current increases when the potential difference is increased* ↑ CORRESPONDENCE

AP011 agreement (*n.*) The state of being identical or equal to. A set of results is in agreement with another set of results if the corresponding values lie within acceptable limits of accuracy. A set of results is in agreement with a law or principle if the results could be predicted by the law or principle, *i.e.* they do not show the law to be false □ *in agreement with* —***agree*** (*v.*) ↑ CORRESPONDENCE

AP012 relate (*v.t.*) To relate *A* to *B* is to find and to make a connection between the concept of *A* and the concept of *B*, *e.g.* the volume of a fixed mass of gas can be related to the pressure of the gas at a constant temperature, *i.e.* a connection is found, and made, between the concept of volume of a gas and the concept of its pressure □ *to relate to* —RELATION, RELATIONSHIP,

interrelation, RELATIVITY (*n.*) RELATIVE (*adj.*) ↓ DEPEND · CORRESPOND · RECIPROCATE · OBEY[1] · CONFORM · REFER ↑, RELATION → CONCEPT

AP013 depend on/upon (*v.t.*) To be connected with or have a relationship to. If *A* depends on *B*, then there is a relation between *A* and *B* such that a change in *B* produces a change in *A*. *A* cannot change by itself; it can only change when *B* changes. For example, the volume of a fixed mass of gas depends upon its pressure and its temperature. If neither pressure nor temperature is altered, the volume cannot be changed. If either pressure or temperature is changed, the volume is changed □ *the current depends upon the resistance in circuit; the current depends on the resistance in circuit.* —***dependent*** (*adj.*) ↑ RELATE → INDEPENDENT (I) · VARY

AP014 correspond (*v.i.*) To be alike in some way without being identical, *e.g.* to have the same structure, function, or situation. *A* corresponds to *B* if *A* matches *B* in structure, or in function, or in situation, *e.g.* ***a*** the rudder of a ship corresponds to the tail of a fish (function of steering and situation); ***b*** the wing of a bird corresponds to the forearm of a primate (structure); ***c*** the two ears of a mammal occupy corresponding positions on opposite sides of its head (situation) □ *the gill of a fish* corresponds to *the lung of a bird* —CORRESPONDENCE (*n.*) ***corresponding*** (*adj.*) ↑ RELATE · CORRESPONDENCE → MATCH (Sn)

AP015 reciprocate (*v.i.*) **1** To go backwards and forwards, up and down, *i.e.* to alternate in diametrically opposed directions, *e.g.* the piston in an engine reciprocates. **2** If *A* performs an action on *B*, and *B*, in return, performs the identical action on *A*, then *B* reciprocates the action of *A*. —***reciprocity, reciprocator*** (*n.*) RECIPROCAL (*adj.*) ↑ RELATE

AP016 obey[1] (*v.t.*) To show significant agreement between measured values and values predicted from a law, principle or rule, *e.g.* an elastic solid obeys Hooke's Law below the limit of elasticity, *i.e.* any measurements made of an extended solid are in significant agreement with predictions of these measurements from applying Hooke's Law. —***obedience*** (*n.*) ↑ RELATE

AP017 conform (*v.i.*) To be in agreement with the predictions of a given law or principle, or pattern of behaviour, *e.g.* ***a*** the extension of a spring under a given load conforms with Hooke's Law provided the elastic limit is not exceeded; ***b*** non-ideal gases do not conform to Boyle's Law, *i.e.* the experimental results are not in agreement with the predicted results □ *the particular rat's behaviour did not* conform to *the normal pattern of behaviour; the variation of electric current with potential difference across the resistor* conformed with *Ohm's Law* —***conformity*** (*n.*) ↑ RELATE

AP018 refer (*v.t.*) To direct attention to a statement, generalization or state of affairs, *e.g.* ***a*** when considering the properties of chlorine it is useful to refer to the general properties of the halogens; ***b*** the meaning of the term 'identical' is made clearer by referring to the term 'similar'; ***c*** the description of atomic structure referred the reader to the properties of electric charge □ *the teacher* referred *the pupil* to *his results* —***reference*** (*n.*) ***referable*** (*adj.*) ↑ RELATE

AP019 compare (*v.t.*) **1 Compare to** To point to the likenesses or similarities, without giving any detail of these likenesses or similarities, *e.g.* to compare a toad to a frog. **2 Compare with** To note the differences and similarities between two or more objects or concepts. If *A* is compared with *B*, then each property, feature, characteristic and disposition of *A* and *B* is examined in detail to show similarities and differences, *e.g.* when comparing a toad with a frog we have, ***a*** both have four digits on the hand (a similarity); the digits on a frog's feet are joined by a thin web throughout their length, but the digits on a toad's foot are joined by a web at the base only (a difference); ***b*** a toad's skin is very dry and very rough, but a frog's skin is smooth and slimy (a difference). —***comparison*** (*n.*) ***comparable*** (*adj.*) ***comparatively*** (*adv.*) ↓ CONTRAST[2] (H) · MATCH · POLARIZE (H) ↑ RELATION

AP020 contrast[2] (*v.t.,i.*) **1** (*v.t.*) To point to differences between two or more objects. If *A* is contrasted with *B*, then each property, feature, characteristic and disposition of *A* and *B* is examined in detail to show differences only, *e.g.* when a toad is *contrasted with* a frog we have, ***a*** a toad's skin is dry and very rough, but a frog's skin is slimy; ***b*** frogs have simple teeth in the upper jaw and on the roof of the mouth, but toads do not. **2** (*v.i.*) To show difference when compared. —CONTRAST (*n.*) ***contrasting*** (*adj.*) ↑ COMPARE

AP021 match (*v.t.,i.*) To choose or to have a quantity, quality, property, pattern, sequence of events or process which is identical with, or similar to, a given quantity, quality, etc., *e.g.* ***a*** to choose a standard resistor for a metre bridge which matches an unknown resistor so that a suitable balance point is obtained on the metre wire; ***b*** the pattern of stripes on a tiger's body matches the pattern of the plant growth in jungle; ***c*** to choose experimental conditions for studying the growth of a plant which match the normal conditions of its growth. —***match*** (*n.*) ↑ COMPARE

AP022 polarize (*v.t.,i.*) **1** (*v.t.*) To separate and group two opposite and opposing states or entities so that two clear groups are perceptible as two distinct 'poles' **2** (*v.i.*) To separate into groups. —POLARITY, POLARIZATION (*n.*) POLAR (*adj.*) ↑ COMPARE

AP023 relative (*adj.*) **1** The term is applied to a physical property when the property itself is expressed as a ratio of the same property of a standard substance, *e.g.* ***a*** the relative density of copper is the ratio of the

density of copper to the density of water, (density is the common property; water is the standard substance); ***b*** the relative atomic mass of copper is the ratio of the mass of one atom of copper to 1/12 the mass of one atom of carbon-12 (mass is the common property; carbon-12 the standard substance). **2** Not independent; considered in relation to something else, *e.g.* terms such as *denser, heavier, sweeter,* etc., are relative terms. The term, relative, also describes a quantity or a quality as perceived by an observer, *e.g.* the relative velocity of an aeroplane as seen by an observer on a moving ship; the aeroplane is said to be moving **relative to** the observer (**relative to** is a compound preposition). ↓ RECIPROCAL · MUTUAL · PROPORTIONAL ↑ RELATION → ABSOLUTE (I)

AP024 reciprocal (*adj.*) Describes a relationship between objects, systems, etc., in which each has the same effect on the other. When *A* performs an action on *B*, and *B* reciprocates, then *B* performs a reciprocal action, *e.g.* two like electrostatic charges, *A* and *B*, repel each other; *A* and *B* have a reciprocal repulsion; *A* has a reciprocal repulsion for *B* (implies *B* repels *A* as well as *A* repels *B*). ↓ MUTUAL (H) ↑ RELATIVE

AP025 mutual (*adj.*) Describes the relationship between *A* and *B* when the relationship is regarded as a two-way process from both sides at the same time. Mutual replaces the phrase 'each other', and can only be used with *A* and *B* together, *e.g.* the repulsion of two like electrostatic charges, *A* and *B*, is mutual; *A* and *B* have a mutual repulsion (a repulsion for each other). *A* and *B* also have a reciprocal repulsion, so mutual and reciprocal are interchangeable in this description, but when either *A* or *B* is considered alone, only reciprocal can be used, *i.e.* *A* has a reciprocal repulsion for *B*, but *A* cannot have a mutual repulsion for *B*. Mutual is preferred to reciprocal in most contexts where both could be used. ↑ RELATIVE

AP026 proportional (*adj.*) Describes a simple arithmetic relation between two or more quantities. The relation can be a direct proportion or it can be an inverse proportion.

Directly proportional As quantity *x* increases, quantity *y* increases so that the ratio *x*/*y* is constant, *e.g.* mass is directly proportional to volume for solids and liquids, so that the ratio mass/volume is constant on any observation; mass and volume are thus directly proportional.

Inversely proportional As quantity *x* increases, quantity *y* decreases so that the product *xy* is constant, *e.g.* the volume of a given mass of gas is inversely proportional to the pressure (at constant temperature), so the product of volume and pressure is constant for any observation. The volume of a gas is thus inversely proportional to its pressure.

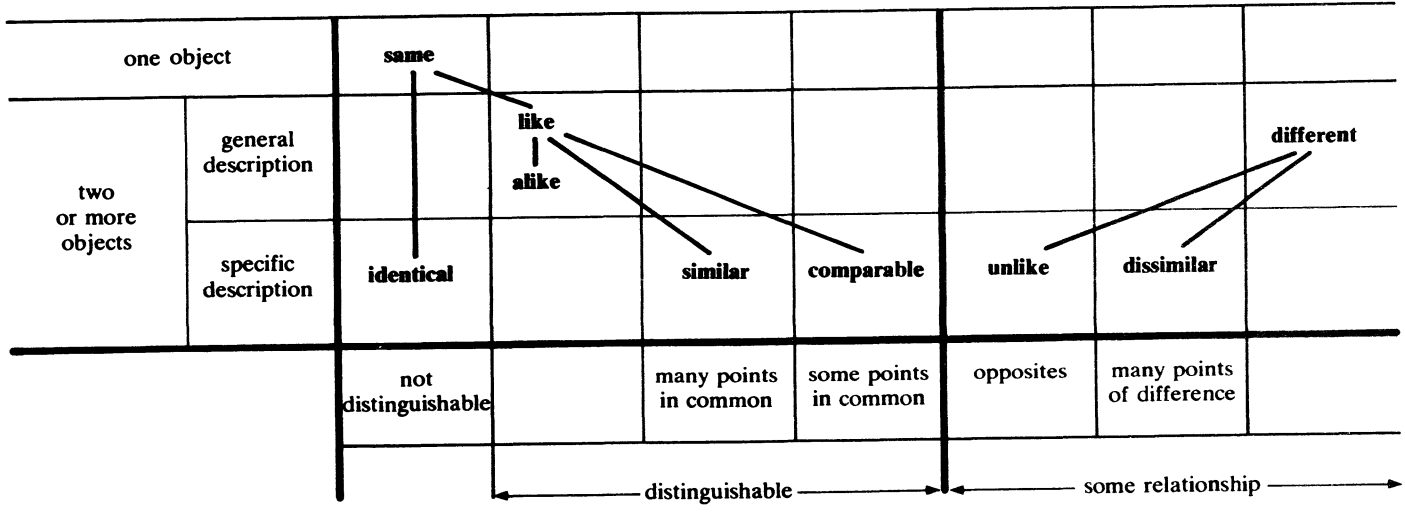
The volume of a gas is inversely proportional to its pressure and directly proportional to its absolute temperature. ***—proportionality*** (*n.*) ↑ RELATIVE

AP027 different (*adj.*) *A* is different from *B* if both have basic properties, qualities, characteristics or features which are not alike, *e.g.* ***a*** three different methods of preparing copper (II) oxide (different features); ***b*** iron is different from brass (different basic properties and qualities). Different is the most general term to show two or more things are not alike; **different, disparate,** and **divergent,** are used to compare *two* objects of discussion; **distinct, separate,** and **discrete,** are used to distinguish one object of discussion from others □ *black copper oxide is different from red copper oxide; black and red copper oxides are different* ***—difference*** (*n.*) ***differ*** (*v.*) ↓ DISTINCT (Sn) · DISSIMILAR · DISPARATE (Sn) · CONTRASTING · SIMILAR (An) · ALIKE (An) · COMPARABLE (An) ↑ RELATION → IDENTICAL (I) · DIVERGENT (Sn) · SEPARATE (Sn)

AP028 distinct (*adj.*) Describes forms of matter or forms of radiation or organisms that can be distinguished by properties, features or qualities. The forms of matter may be related or connected, *e.g.* there are three common varieties of malaria caused by three distinct species of a protozoan, *Plasmodium.* (It needs careful observation to distinguish the different species, but they are distinct; they are related by their characteristics and features as belonging to the same genus) □ *one species of mosquito is distinct from another* ***—distinction*** (*n.*) ***distinctive*** (*adj.*) ↑ DIFFERENT → SEPARATE · SEPARABLE (Sn)

AP029 dissimilar (*adj.*) *A* and *B* are dissimilar when they have more differences than likenesses. Contrast **unlike, different,** and **dissimilar**. Unlike: *A* and *B* have a common category, but differ in basic features, *e.g.* unlike electrical charges (common category of electric charge, basic difference of positive and negative). Dissimilar: *A* and *B* have some features in common but more features are not common (its use is not common). Different: *A* and *B* have one or more basic features which place them apart, *e.g.* ***a*** two different like electric charges (both have the same sign, but not the same magnitude); ***b*** iron and copper have different chemical properties (two metals with some similar physical features, but with basic properties by which they can be distinguished). ↓ SIMILAR (I) ↑ DIFFERENT (Sn) → UNLIKE (Sn)

AP030 disparate (*adj.*) Describes the properties, qualities or characteristics of *A* and *B* when there is a big quantitative or qualitative difference between a property, quality or characteristic of each of them, *e.g.* there is a disparate growth shown between a seedling grown in the light and one grown in the dark (the growth of one seedling is out of proportion to the growth of the other, the one in the dark growing



SAME & RELATED TERMS

much longer). ↓ COMPARABLE (I) ↑ DIFFERENT (Sn) · DISTINCT (Sn) → SEPARATE

AP031 contrasting (*adj.*) Describes a notable difference and draws attention to the difference, *e.g.* blue and red are contrasting colours, *i.e.* there is a noticeable difference between these colours and attention is drawn to the difference when the colours are placed side by side. ↑ DIFFERENT

AP032 alike (*adj.*) If *A* is like *B*, then *A* and *B* are alike. Like is used to qualify a noun; alike must be used with the verb 'to be'. For two things to be alike, there must be a one to one correspondence in distinctive properties, qualities, characteristics or features, but not necessarily in small detail. (A correspondence in all detail makes *A* and *B* identical). For example, the reactions of sodium and potassium with water are alike in the formation of the hydroxide and the evolution of hydrogen (no distinction between the results); the reactions are different in the vigour of the reaction, and the combustibility of the hydrogen evolved; for this reason the reactions are alike (a distinction can be drawn between the reactions, but they have several features in common). —***likeness*** (*n.*) ↓ SIMILAR (Sn) · IDENTICAL · COMPARABLE · APPROPRIATE ↑ RELATION

AP033 similar (*adj.*) *A* is similar to *B* if both have many like properties, qualities or characteristics, but each has some properties, qualities or characteristics which are not alike, so that *A* can be distinguished from *B*, *e.g.* ***a*** the properties of the halogens are similar (yet each halogen can be distinguished from the others); ***b*** all birds have similar characteristics, *e.g.* they all have beaks, but they do not all have webbed feet, *i.e.* one kind of bird can be distinguished from another. To distinguish between **same, identical** and **similar**— ***a*** for objects and organisms, (1) The man wore the same hat yesterday and today (he had only one hat). (2) The man wore identical hats yesterday and today (he had two hats, but it was not possible to distinguish between them) (3) The man wore similar hats yesterday and today (he had two hats which were alike, but it was possible to distinguish between them). ***b*** for properties, qualities, quantities, characteristics, (1) Two flowers can have the same colour *or* the colour of each of two flowers is identical (*same* and *identical* are interchangeable in use here.) (2) Two flowers can have similar colours, *e.g.* two kinds of yellow. —***similarity*** (*n.*) ***similarly*** (*adv.*) ↓ IDENTICAL (H) ↑ ALIKE · DISSIMILAR (An) → CLASS · TYPE · CATEGORY

AP034 identical (*adj.*) Agreeing entirely in material constitution, qualities and meaning. For two things to be identical, there must be a one to one correspondence for all properties; that is, if *A* and *B* are identical, then *A* and *B* have the same number of properties, and these properties are exactly the same ↑ ALIKE

AP035 comparable (*adj.*) ↓ Describes properties, qualities or characteristics that can be compared, *e.g.* ***a*** the properties of the alkali metals are comparable, as the properties of each metal are similar to one another; ***b*** the wings of birds and the forelegs of quadrupeds are comparable from the point of view of their skeletal structure. **2** Describes quantities that do not differ greatly in magnitude, *e.g.* ***a*** the body temperatures of all mammals are comparable (they range between 36°C and 40°C); ***b*** the electric currents used in electrical appliances are comparable (they range between 5 A and 13 A) when compared with the current taken by electromagnets, *e.g.* of the order of 100 A. ↑ ALIKE

AP036 appropriate (*adj.*) Describes an object, action, process or arrangement which is especially or solely suitable for the occasion or situation, *e.g.* ***a*** any converging lens (positive lens) is suitable for improving the eyesight of a person with long sight, but a converging lens of the correct focal length is appropriate for use in his spectacles; ***b*** an ester is formed from the appropriate alcohol and appropriate organic acid. ↑ ALIKE

AP037 identity (*n.*) The sum of the characteristics and qualities which make an organism or object what it is. ↓ CLASSIFICATION[1] · TEST[1] · SAMPLE[1] · CLASSIFY · TEST[2] · IDENTIFIABLE ↑ RELATION → EXISTENCE

AP038 classification[1] (*n.*) **1** The action of classifying, *i.e.* putting members into categories. **2** The result of classifying, *e.g.* the classification of plants and animals in biology is important in teaching biology. ↓ CATEGORY · CLASS[1] ↑ IDENTITY → CLASSIFICATION[2]

AP039 category (*n.*) One of the divisions in a system of classification; a category is always an abstraction; it details the essential properties for class membership, *e.g.* all metals differ one from the other, but the abstraction of the concept 'metal' forms the category. As the theory of a science develops and changes, the categories of the theory also change. For example, the categories of metal and non-metal are not so important in modern theories of chemistry; modern categories of elements are based on the groups of the Periodic System. The categories of classification in biology are kingdom, phylum, class, order, family, genus and species; these categories are based on theories of the structure of organisms. —***categorize*** (*v.*) ↑ CLASSIFICATION[1]

AP040 class[1] (*n.*) A class is a group or collection of objects, substances, radiations or organisms chosen because of their similarities. The types of similarities are, ***a*** genetic similarity, *i.e.* a similarity of origin, or source; ***b*** structural similarity, *i.e.* similarity between objects or organisms, having similar parts, or similar relations between their parts; ***c*** functional similarity, *i.e.* similarity of behaviour. A class may contain many individuals if few similarities are used

to define it, and few individuals if many similarities are used to define it. For example, ***a*** radioactive radiations (a class of radiations with the same origin); ***b*** crystalline compounds (a class of compounds with similar structure); ***c*** muscle cells (a class of cells with the same behaviour); ***d*** acids are a class of chemical compounds defined from their property of forming hydrogen ions in aqueous solution; carboxylic acids have a narrower definition as they must also include a carboxyl group; amino acids have a still narrower definition as they must also include an amino group. As the similarities increase and the definition becomes narrower the number of members of the class becomes smaller □ *a sub-class; a restricted class; a limited class* —CLASSIFY, ***class*** (*v.*) ***classifiable*** (*adj.*) ↓ TYPE (Sn) ↑ CLASSIFICATION[1] · CATEGORY (Sn) → CLASS[2]

AP041 test[1] (*n.*) The act of using a reagent or reagents to identify a substance or a group of substances. The test allows an observation to be made and the observation suggests an inference. Some tests give an answer immediately, *e.g.* the test for chloride ions in solution; other tests may tell us that the substance is one of a small group of substances, or perhaps there is some slight doubt about the identity of the substance. A final test which leaves no doubt and confirms the original inference is called a **confirmatory test** □ *to carry out a test on a sample; to apply a test to a sample* —***test*** (*v.*) ↓ IDENTIFICATION · RECOGNITION ↑ CLASSIFICATION[1] → INFERENCE

AP042 identification (*n.*) The process of identifying. ↑ TEST[1] → IDENTIFY

AP043 recognition (*n.*) The act or process of knowing or identifying from past experience. Recognition assumes a previous identification, *e.g.* the recognition of a gas by its smell is possible if the smell has been identified on a previous occasion. ↑ TEST[1]

AP044 sample[1] (*n.*) A small portion taken from a whole, by which the characteristics of the whole can be found, *i.e.* the characteristics of the whole are unknown, and are investigated from the sample, *e.g.* ***a*** a small portion of blood is taken for investigating a person's health (a blood sample); ***b*** in the manufacture of drugs, a small portion of the product is taken at suitable intervals to test its purity; the purity of the sample is representative of the purity of the whole product □ *to take a sample; to test a random sample* —SAMPLE (*v.*) ↓ SPECIMEN · TYPE ↑ CLASSIFICATION[1]

AP045 specimen (*n.*) A portion or an individual taken to be a representative of a whole or group. The characteristics of the whole or group are known and the specimen is selected for the purpose of instruction or examination, *e.g.* ***a*** a chicken is a suitable specimen for the study of the general external features of a bird; ***b*** a portion of salt is a suitable specimen for the study of crystalline structure. ↑ SAMPLE[1]

AP046 type (*n.*) **1** A specimen, or an individual, with the essential properties, characteristics or structures of the class or group of which it is a member, *e.g.* ***a*** ethanoic acid as a type of carboxylic acid; ***b*** a cockroach is a type of insect. **2** An example or form of; here the term is used in the same way as **kind**, *e.g.* a type of bottle with a long neck. —***typical*** (*adj.*) ***typify*** (*v.*) ↑ SAMPLE[1]

AP047 classify (*v.t.*) To put members into their categories according to their nature, structure or properties, *e.g.* ***a*** putting copper into the category of metals because of its characteristic properties; ***b*** putting a horse into the category of mammals because of its characteristic features; ***c*** putting graphite into the category of conductors, because of its property of conducting an electric current □ *copper is classified as a metal* —CLASSIFICATION (*n.*) ↑ CLASSIFICATION[1]

AP048 test[2] (*v.t.*) To apply a procedure to a piece of apparatus or to an instrument to make sure it is in good working order, *e.g.* ***a*** to test an apparatus for airtightness; ***b*** to test an ammeter to see that it is working □ *the instrument is under test* —TEST, ***testing*** (*n.*) ↓ IDENTIFY · RECOGNIZE · SAMPLE[2] · REPRESENT[1] ↑ CLASSIFICATION[1] → CALIBRATE

AP049 identify (*v.t.*) **1** (Bio., Ch., Ph.) To give a name to a piece of matter, a process, or a radiation, by comparing it with a like piece of matter, process, or radiation, whose properties are known, *e.g.* a solid which has the same properties as copper (II) sulphate crystals, such as a blue colour, the same crystalline shape, the same solubility, and the same chemical reactions, is identified as copper (II) sulphate crystals. A bacterium is identified by finding its characteristics and so naming it. **2** (G.S.) To isolate an object, process, or radiation, from among a number of objects, processes, and radiations, by using either the senses or instruments which extend the senses, *e.g.* ***a*** in identifying almost all radiations, no senses are suitable, but a photographic plate, through a developed image, extends the sense of sight; ***b*** in identifying an organ in a dissection, the object has been isolated. —IDENTIFICATION, ***identity*** (*n.*) IDENTIFIABLE (*adj.*) ↓ RECOGNIZE (Sn) ↑ TEST[2]

AP050 recognize (*v.t.*) To know from past experience. If an object, property, sequence, configuration, quality, or characteristic has been previously identified, then subsequently it can be matched against the identification to be recognized, *e.g.* to recognize a tiger, the animal must have been previously identified, *i.e.* isolated from all other species of animals on a previous occasion. — ***recognition*** (*n.*) ***recognizable*** (*adj.*) ↑ TEST[2] · IDENTIFY (Sn)

AP051 sample[2] (*v.t.*) To take samples; the method of selection of the samples depends upon the nature of the material, or of the population, and the requirements to obtain representative samples. —***sampling*** (*n.*) ↑ TEST[2]

AP052 represent[1] (*v.t.*) To be a particular

example of a kind or class of objects or individuals, *e.g.* ***a*** the properties of chlorine can be taken to represent the properties of the halogens; ***b*** the external features of a chicken can be taken to represent the general external features of a bird. —***representative*** (*n.*) ***representative*** (*adj.*) ↑ TEST[2]

AP053 identifiable (*adj.*) Able to be identified. ↓ UNIDENTIFIABLE (An) ↑ CLASSIFICATION

AP054 unidentifiable (*adj.*) Describes an object, event, process or radiation which cannot be identified owing to lack of information or incomplete observation. ↑ IDENTIFIABLE (An)

Experiment

AQ001 experiment (*n.*) 'An experiment is an artificial device for putting the observer in a favourable position with respect to nature' (Caws). An experiment is an operation carried out to study by observation the behaviour of substances, materials or organisms under definite circumstances. The circumstances are controlled by the observer to isolate that part of a phenomenon or reaction he wishes to observe and the conditions under which they happen, *e.g.* ***a*** an experiment to determine the modulus of elasticity of steel (elasticity is the phenomenon, and the observer makes suitable apparatus, such that only this phenomenon with regard to steel is observed); ***b*** the study of the behaviour of sodium chloride when it reacts with sulphuric acid; ***c*** the study of the behaviour of plants when fertilizers are added to the soil. The object of an experiment is to obtain new knowledge. Experiments may lead to new empirical generalizations or may test hypotheses and theories. —EXPERIMENTAL (*adj.*) ***experiment*** (*v.*) ↓ TOOL · MECHANISM[1] · SET UP · MECHANICAL[1] · EXPERIMENTAL · TECHNIQUE · ILLUSTRATION

AQ002 tool (*n.*) An object which is held in the hand or hands, and is used to assist a person in doing manual work, *e.g.* a chisel, a screwdriver, and pliers. In general speech the difference between tool and **instrument** implies that the work carried out with an instrument is more delicate, and requires more knowledge. ↓ MACHINE · INSTRUMENT (Sn) · METER ↑ EXPERIMENT

AQ003 machine (*n.*) **1** (Ph.) A device by means of which a force applied at one point can be used to overcome a force at another point, *e.g.* a lever, a system of pulleys, a screw, a wheel and axle. **2** (G.S.) A device, or a system of devices, made of interconnected parts, which takes in some form of energy, modifies the energy, and delivers the energy in a suitable form for a desired effect. The motor car is a machine; it takes in chemical energy in the form of petrol, and, by a system of interconnected parts, transforms the chemical energy into kinetic energy, which is then transmitted through other interconnected parts to the wheels, where motion is given to the car: motion is the desired effect. —MACHINERY (*n.*) ↓ DEVICE ↑ TOOL → ENGINE (Sn) · MOTOR (Sn)

AQ004 instrument (*n.*) **1** (G.S.) An object used by a person for making, doing, or effecting something, *e.g.* a musical instrument for making music; dissecting instruments for carrying out a dissection. **2** (Bio., Ch., Ph.) The term, **scientific instrument**, implies that the device is used for detecting, measuring, or recording. Examples are Geiger counter, photometer, electroscope, spectroscope, spectrometer, ammeter, thermometer, barometer, barograph. Instruments used, ***a*** for qualitative measurements have the ending *-scope*; ***b*** for quantitative measurements have the ending *-meter*; ***c*** for recording quantitative measurement have the ending *-graph*. For example: a spectroscope examines a spectrum qualitatively; a spectrometer measures the wavelengths of light in a spectrum. A barometer measures quantitatively the atmospheric pressure; a barograph records the quantitative measurements of atmospheric pressure on a graph. ↑ TOOL → APPARATUS

AQ005 meter (*n.*) An instrument which measures a variable quantity, usually having a scale with a moving pointer, *e.g.* ***a*** a speedometer measures speed (speed can vary); ***b*** an ammeter measures electric current (electric current can vary). ↑ TOOL

AQ006 mechanism[1] (*n.*) **1** A structure of movable parts which interact mechanically, *e.g.* ***a*** the mechanism of a clock; ***b*** the mechanism of a typewriter. **2** The chain of events in a particular process, *e.g.* ***a*** the mechanism is the chain of events in a complex machine; ***b*** the mechanism of gravitational force is unknown, *i.e.* the chain of events producing attraction between an object and the earth is unknown. ↓ DEVICE · APPARATUS · COUNTERPOISE ↑ EXPERIMENT · TOOL · MACHINE

AQ007 device (*n.*) An object cleverly or especially made for a special purpose, *e.g.* ***a*** a thermostat is a device for maintaining a constant temperature; ***b*** a compass in a coil of wire is a simple device for detecting an electric current. —***devise*** (*v.*) ↑ MECHANISM[1]

AQ008 apparatus (*n.pl.* **apparatus** *or* **apparatuses**) Scientific apparatus describes all objects, tools, instruments and machines used in the laboratory for scientific work, *e.g.* test tube, beaker, photometer, flask, condenser, resistor, electrical cell, gas burners □ *the apparatus for*

distillation is assembled ↑ MECHANISM[1] → TOOL (H) · INSTRUMENT (H) · MACHINE (H)

AQ009 counterpoise (*n.*) An equal or balancing mass or force. In chemistry a counterpoise is used for practical purposes when weighing out chemicals to avoid weighing the container. Modern single pan balances make this unnecessary. —***counterpoise*** (*v.*) ↑ MECHANISM[1]

AQ010 set up (*v.t.*) **1** To collect and to connect together separate pieces of apparatus to make a whole apparatus ready for an experiment, *e.g.* to take a flask, a condenser, a tripod, a burner, a thermometer, and a receiver, and to connect them together correctly, is to set up an apparatus for distillation. **2** To provide suitable conditions for a biological experiment, *e.g.* seeds are planted in sand and watered with solutions containing different nutrients to set up an experiment on plant nutrition. ↓ CALIBRATE · CARRY OUT · DEMONSTRATE ↑ EXPERIMENT

AQ011 calibrate (*v.t.*) To make a scale on an instrument or measuring device so that the instrument or device can be used to measure the magnitude of quantities in specified units, *e.g.* a mercury thermometer is calibrated by making marks against the level of the mercury at the temperatures of freezing water (ice point) and of boiling water (steam point), and then dividing the distance between these marks into 100 divisions, forming a Celsius scale of temperature. —***calibration*** (*n.*) ↑ SET UP

AQ012 carry out (*v.t.*) To bring a process, experiment, or investigation to its completion, *e.g.* ***a*** the preparation of sulphur (VI) oxide is carried out in the laboratory by passing a mixture of sulphur dioxide and oxygen over a catalyst of vanadium pentoxide at a temperature of 450°C and collecting the product in a vessel cooled in a freezing mixture; ***b*** an investigation into the factors affecting photosynthesis is carried out by setting up experiments showing the effect of sunlight, chlorophyll, and carbon dioxide on photosynthesis, and recording the results. ↑ SET UP

AQ013 demonstrate (*v.t.*) To show clearly and to explain by experiments, displaying examples, or by a mathematical proof, *e.g.* ***a*** the manufacture of sulphuric acid by the contact process can be demonstrated by a working model of the plant; ***b*** the properties of elasticity and plasticity can be demonstrated by displaying samples of materials with these properties; ***c*** Euclid demonstrated that the sum of the angles of a triangle is equal to two right angles. ↑ SET UP

AQ014 mechanical[1] (*adj.*) **1** Describes a process or function using machines or machinery, or describes a device which is a machine, *e.g.* mechanical skills, mechanical method, a mechanical stirrer, a mechanical mixture. **2** Concerning the processes of mechanics, *e.g.* ***a*** the mechanical advantage of a machine is the load divided by the effort; ***b*** mechanical energy which is potential energy or kinetic energy. ↓ SENSITIVE[2] · EFFICIENT ↑ EXPERIMENT → MECHANICS · ELECTRICAL (Sn) · THERMAL (Sn) · ACOUSTICAL (Sn) · MAGNETIC (Sn) · ELECTROMAGNETIC (Sn) · RADIANT (Sn)

AQ015 sensitive[2] (*adj.*) Describes a scientific instrument which gives a perceptible increase in a reading for a very small increase in the force or quantities of energy being measured, *e.g.* a sensitive balance measures very small differences in weight. —***sensitivity*** (*n.*) ↑ MECHANICAL[1]

AQ016 efficient (*adj.*) Describes a machine, piece of apparatus or device which performs an operation with a satisfactory or successful result, *e.g.* ***a*** an efficient machine wastes very little of the work put into it; ***b*** a non-magnetic metal sheet is an efficient screen for magnetic fields with a high frequency alternating magnetic flux, as eddy currents prevent the magnetic flux penetrating into the metal sheet. —***efficiency*** (*n.*) ↑ MECHANICAL[1] → EFFICIENCY

AQ017 experimental (*adj.*) Of or to do with experiment or an experiment, *e.g.* ***a*** experimental evidence is evidence obtained by experiment; ***b*** experimental techniques are techniques used in experiments. ↑ EXPERIMENT

AQ018 technique (*n.*) A technique includes the knowledge of a subject together with the necessary mechanical or manipulative skills to carry out an activity in that subject. For example there is a technique, ***a*** for growing large crystals of inorganic salts; this involves, (i) a knowledge of the subject crystallization, (ii) the manipulative skill to prepare a suitable solution and assemble the necessary apparatus; ***b*** for dissecting the alimentary canal of a frog; this involves, (i) a knowledge of the anatomy of the frog, (ii) the necessary manipulative skill to cut the tissues. A method or procedure for carrying out an operation. ↓ MANIPULATION · DIRECTION[2] · INSTRUCTION · COLLECT · DETECT ↑ EXPERIMENT

AQ019 manipulation (*n.*) **1** The method of handling apparatus, instruments and materials in an experiment. **2** The manipulation of a formula is the rearranging of the formula to make it useful for a particular calculation. —MANIPULATE (*v.*) ***manipulative*** (*adj.*) ↑ TECHNIQUE

AQ020 direction[2] (*n.*) One of a list of actions in the correct order in which they have to be carried out. The term is used to describe the actions of practical work and also the path to be followed to reach a required point in space, *e.g.* ***a*** the directions to set up the apparatus for the determination of the acceleration due to gravity; ***b*** the directions to find a particular bird's nest in a habitat □ *follow the directions carefully* —***direct*** (*v.*) ↑ TECHNIQUE

AQ021 instruction (*n.*) One of a list of actions in the correct order in which they have to be carried out together with the reason for the actions. Compare **directions** in which the reasons for carrying out the

actions are not given, *e.g.* the instructions to set up and use the apparatus for the determination of the acceleration due to gravity includes the purpose of the parts of the apparatus □ *follow the instructions* ↑ TECHNIQUE · DIRECTION (H)

AQ022 collect (*v.t.,i.*) **1** (*v.t.*) (Ch.) To isolate from the products of a reaction, by using a suitable technique, one or more substances which are required as a specimen, *e.g.* ***a*** collecting gases over water; ***b*** collecting a distillate in a receiver; ***c*** collecting crystals by pouring off the supernatant liquid. **2** (*v.t.*) (Bio.) To gather some objects together for a purpose, *e.g.* collecting butterflies for examination under a hand lens. **3** (*v.i.*) (Bio., Ch., Ph.) To gather or come together, *e.g.* ***a*** bubbles collect on the electrode of a simple cell when it is working; ***b*** a sediment collects at the bottom of the flask; ***c*** houseflies collect on refuse dumps. —***collection*** (*n.*) ↓ UTILIZE · MANIPULATE · MOUNT[1] · INSTRUCT ↑ TECHNIQUE → GROUP · SPECIMEN

AQ023 utilize (*v.t.*) To use for practical or profitable purpose, *e.g.* the slow combustion of phosphorus at room temperature is utilized in a method for finding the composition of the air. —***utilization, utility*** (*n.*) ***utilizable*** (*adj.*) ↑ COLLECT → APPLY

AQ024 manipulate (*v.t.*) To work by some manual process, *i.e.* using the hand. This can also be by use of an instrument which is itself worked by hand, *e.g.* the glass blower manipulates his iron tube to give the molten glass its shapes. The word is also used of handling apparatus in the laboratory. —MANIPULATION (*n.*) ↑ COLLECT

AQ025 mount[1] (*v.t.*) To plan and arrange, *e.g.* to mount an experiment to measure the velocity of light. ↑ COLLECT

AQ026 instruct (*v.t.*) To teach the methods of a technique to a person, *e.g.* to instruct a pupil in the technique of fractional distillation □ *the man instructed his pupil in the solution of quadratic equations* —***instruction*** (*n.*) ↑ COLLECT

AQ027 detect (*v.t.*) To observe positive signs by suitably designed tests which lead to the discovery of the presence, or the identification, of a substance, object, organism or radiation, *e.g.* ***a*** to detect the presence of arsenic in a herbicide; ***b*** to detect the presence of dissolved ions in a sample of water; ***c*** to detect pathogens in the blood; ***d*** to detect X-rays by a photographic plate. —***detection*** (*n.*) ↑ TECHNIQUE → EXPERIMENT

AQ028 illustration (*n.*) **1** An example in words, a picture, or a diagram or sketch, that helps an explanation to be vivid and clearer. **2** (G.S.) A picture used to make a description, or statement, or discussion, easier to understand. ↓ SKETCH · ILLUSTRATE · SKETCHY ↑ EXPERIMENT

AQ029 sketch (*n.*) A drawing of the main lines or main features of objects, or a description in words, main features or main points, with the result that a clear, but not detailed, picture or account is given, *e.g.* ***a*** a sketch of the apparatus used for distillation (the drawing is not accurate, but shows sufficient detail for a clear understanding of the apparatus.); ***b*** a sketch of the layout of an electrical circuit for measuring the e.m.f. of a cell (symbols are used for each device and connections are indicated by lines); ***c*** a sketch of the distribution of plants in an area (the map of the area is not detailed, and need not be to scale, but sufficient points are shown for the description to be followed). —***sketch*** (*v.*) SKETCHY (*adj.*) ↓ OUTLINE · DIAGRAM · SUMMARY · LABEL[1] ↑ ILLUSTRATION

AQ030 outline (*n.*) A drawing showing the outside boundaries of an object, or a brief description, in words, giving a summary of a process, *e.g.* ***a*** a diagram of a flask showing its outline; ***b*** an outline of the process for extracting iron from its ores (only the main features of the process are summarized). Note: **sketch** is used for descriptions of objects and fixed structures, but **outline** is used for descriptions of methods and processes. —***outline*** (*v.*) ↓ SUMMARY ↑ SKETCH

AQ031 diagram (*n.*) A drawing, consisting of lines, which represents an object, state or process, and is concerned with an explanation of the object, etc., more than with a representation. The explanation is sometimes made clear by labels, *e.g.* ***a*** a diagram of an electric cell uses lines to show the parts of the cell, and each part is described by a label to make the drawing easily understood; ***b*** a diagram of a flower shows the arrangement of the parts, with each part clearly labelled □ *draw a diagram of the apparatus; a well-labelled diagram of the kidney* ↓ LABEL[1] · REPRESENT[2] ↑ SKETCH → FLOW DIAGRAM · FLORAL DIAGRAM

AQ032 summary (*n.*) A short account giving the important facts only and not giving any detail, *e.g.* at the end of a section of a textbook, a summary states the important laws, theories and facts that have been described in detail. ↑ SKETCH

AQ033 label[1] (*n.*) A description, usually one word, written by the side of a diagram, sketch, or drawing, with a line drawn to the part it describes, *e.g.* a drawing of a plant cell with a label *cell wall* connected by a line to the outer edge of the cell. —***label*** (*v.*) ***labelled*** (*adj.*) ↑ SKETCH

AQ034 illustrate (*v.t.*) To give examples helped by pictures, sketches or diagrams, not only to make a description clear, but also to make the explanation detailed and real. If a general statement is illustrated with diagrams the explanation is clearer than if it is only exemplified, *e.g.* the behaviour of a crystal of potassium manganate (VII) in a beaker of water provides an **example** of the diffusion, and it can be stated to **exemplify** diffusion. If this example is used to illustrate the term *diffusion* then a more detailed statement, describing the movement of the ions, and the final result, should be given. Diagrams or sketches can be used to make the details

of the movement of ions clearer than the use of words alone. —ILLUSTRATION (*n.*) ***illustrated*** (*adj.*) ↓ REPRESENT[2] · LABEL[2] ↑ ILLUSTRATION

AQ035 represent[2] (*v.t.*) To serve as a likeness of a concept, either by putting before the senses a diagram, outline, sketch, picture, description, or by the imagination, *e.g.* ***a*** an outline drawing of a flask in a distillation apparatus represents the flask (when the drawing is seen, it enables the observer to think about the flask); ***b*** the drawing of a carbon atom represents the atom (it serves as a likeness for the theoretical concept of the atom). (Note the difference between a **symbol** and a **representation**: C is the symbol for a carbon atom – it is a convention that C stands for a carbon atom in a formula; a representation of a carbon atom is a picture of the atom.) ***c*** A straight line can represent a force in magnitude and direction. —***representation*** (*n.*) ***representative*** (*adj.*) ↑ ILLUSTRATE

AQ036 label[2] (*v.t.*) To write labels on a diagram, sketch or drawing, *e.g.* to draw the apparatus for distillation and then label the flask, the condenser and the receiver. A fully labelled diagram is one in which every possible part and process have been given a label. ↑ ILLUSTRATE

AQ037 sketchy (*adj.*) A drawing, description, statement or discussion that lacks detail. ↓ FULLY ↑ ILLUSTRATION

AQ038 fully (*adv.*) Completely, *e.g.* a fully labelled diagram is one which has been completely labelled in all detail. ↑ SKETCHY → INADEQUATELY (Ag)

Scientific Terms

Physical Properties

BA001 physical property (*n.*) A property of an object or material that involves no chemical change. The object retains its character throughout the events in which it takes part and does not change chemically. ↓ LUSTRE · GRADATION · IMPART[2] · FUSE[1] · LUSTROUS · DULL · MACROSCOPIC PROPERTIES

BA002 lustre (*n.*) The quality possessed by a surface of shining by reflected light □ *a metallic lustre; a pearly lustre; a silky lustre; a waxy lustre.* —LUSTROUS (*adj.*) ↓ FUSIBILITY · VISCOSITY[2] · MALLEABILITY · DUCTILITY ↑ PHYSICAL PROPERTY

BA003 fusibility (*n.*) The disposition of being able to melt; a measure of the ease with which a solid substance will become molten when heated. —FUSE (*v.*) FUSIBLE (*adj.*) ↑ LUSTRE

BA004 viscosity[2] (*n.*) The disposition of resisting flow, *e.g.* treacle has a high viscosity. —VISCOUS (*adj.*) ↑ LUSTRE

BA005 malleability (*n.*) The disposition of being malleable; it is one of the physical properties of metals. —MALLEABLE (*adj.*) ↑ LUSTRE

BA006 ductility (*n.*) The disposition to be drawn out into a wire. —DUCTILE (*adj.*) ↑ LUSTRE

BA007 gradation (*n.*) The perceptible passing from one state to another, *e.g.* the gradation of physical properties in the paraffin series – increase in the number of carbon atoms is accompanied by rise in boiling point. ↑ PHYSICAL PROPERTY

BA008 impart[2] (*v.t.*) To give to something or someone, some immaterial gift or disposition, *e.g.* ***a*** to impart knowledge; ***b*** cloves impart their flavour to food; ***c*** the property of solubility in water is imparted to the lower alcohols by the —OH group. ↓ PREDOMINATE ↑ PHYSICAL PROPERTY

BA009 predominate (*v.t.*) To exert a marked influence over or in contrast to other factors, *e.g.* in the higher alcohol $C_7H_{15}OH$ the influence of the carbon chain (C_7H_{15}) predominates over the —OH group so that the compound is insoluble in water. —***predominant*** (*adj.*) ↑ IMPART[2]

BA010 fuse[1] (*v.t.,i.*) **1** (*v.i.*) To melt; the term is often used of substances that exist as powders or small particles; in melting they form a single mass. **2** (*v.t.*) To cause a substance to melt. The term is also used in the sense of to join together by melting. —FUSIBILITY (*n.*) ↑ PHYSICAL PROPERTY → LIQUEFY (Sn) MELT[1] (Sn)

BA011 decolorize (*v.t.*) To take away colour from; the term usually implies changing a coloured compound into a colourless one, *e.g.* when purple acidified potassium manganate (VII) solution is decolorized, it is converted into a pale pink manganese (II) salt; this in dilute solution appears colourless. —***decolorization*** (*n.*) ↓ BLEACH[2] → ISOLATE

BA012 bleach[2] (*v.t.*) See **bleach[1] (BB052).** → ISOLATE

BA013 lustrous (*adj.*) Describes materials which possess a surface which reflects, *e.g.* ***a*** a lustrous silver spoon reflects light; ***b*** polished brass is lustrous. —LUSTRE (*n.*) ↓ FUSIBLE · VISCOUS[1] · MALLEABLE · DUCTILE[1] · ABRASIVE ↑ PHYSICAL PROPERTY

BA014 fusible (*adj.*) Easily fused, *i.e.* changed into a liquid state, *e.g.* fusible slag is that mixture of silicates which will become molten and so can be separated, *i.e.* the slag separated from the pig iron in the blast furnace. —FUSE[1] (*v.*) ↓ INFUSIBLE (An) ↑ LUSTROUS

BA015 viscous[1] (*adj.*) Flowing slowly; having a high viscosity. —VISCOSITY (*n.*) ↓ MOBILE[2] (Ag) ↑ LUSTROUS

BA016 malleable (*adj.*) Describes substances which can have their shape changed permanently by the application of stress, such as hammering or pressing into thin sheets, *e.g.* copper is malleable because it can be hammered into thin sheets. —MALLEABILITY (*n.*) ↓ BRITTLE (I) ↑ LUSTROUS

BA017 ductile[1] (*adj.*) Possessing properties which allow the material to be drawn out into a wire. —DUCTILITY (*n.*) ↑ LUSTROUS

BA018 abrasive (*n.*) A material which wears down other materials by friction. —ABRASION (*n.*) ↑ LUSTROUS

BA019 excess[2] (*n.*) More than enough to do the job, *e.g.* ***a*** if an excess of hydrochloric acid is added all the calcium carbonate will dissolve; ***b*** when methane is burned in an excess of oxygen (*or* burned in excess oxygen) carbon dioxide and water are formed □ *excess of; in excess* —***excessive, excess*** (*adj.*) ↑ PHYSICAL PROPERTY

BA020 dull (*adj.*) Describes a surface from which light is not reflected except in a diffuse manner; the surface does not shine, *e.g.* lead exposed to the air for some time has a dull surface. ↓ INFUSIBLE · MOBILE[2] · BRITTLE · REFRACTORY[1] ↑ PHYSICAL PROPERTY

BA021 infusible (*adj.*) Describes a solid which cannot be changed under normal conditions into a liquid; the term can also be applied to a substance which changes directly from solid to vapour. Here the focus is on the non-production of a liquid, *e.g.* mercuric chloride forms two white compounds with ammonia, fusible white precipitate which does form a liquid and infusible white precipitate which does not. ↑ FUSIBLE (An)

BA022 mobile[2] (*adj.*) Describes something or a substance, such as a liquid, which can move or be moved easily and freely, *e.g.* when sulphur is heated gently an amber

mobile liquid is formed which moves easily in the tube when it is tilted. —***mobility*** (*n.*) ↑ DULL · VISCOUS[1] (Ag)

BA023 brittle (*adj.*) Describes a substance which breaks into pieces under stress, *e.g.* ***a*** crystal of rhombic sulphur is brittle; ***b*** a piece of glass is brittle. —***brittleness*** (*n.*) ↑ DULL · DUCTILE[1] (I) · MALLEABLE (I)

BA024 refractory[1] (*adj.*) Describes materials which can be heated to high temperatures without damage and are also resistant to corrosion by materials in contact with them. There are three types, ***a*** acid refractory materials, *e.g.* fire clay; ***b*** neutral refractory materials, *e.g.* graphite, chromite and some carbides; ***c*** basic refractory materials, *e.g.* lime, magnesia and alumina. —REFRACTORY (*n.*) ↑ INFUSIBLE (H) · DULL

BA025 macroscopic properties (*n.pl.*) The features of the physical world which are most obvious to us. Properties such as pressure, volume, temperature, composition and mass, are macroscopic properties. They are the properties of matter in bulk rather than those of individual isolated molecules. ↓ DENSITY[2] · DENSE[1] · MICROSCOPIC PROPERTIES (I) ↑ PHYSICAL PROPERTY → THERMODYNAMICS

BA026 density[2] (*n.*) The density of a substance is its mass per unit volume, *e.g.* the density of copper at 20°C is 8·96 g cm^{-3}, *i.e.* 1 cm^3 of copper at 20°C has a mass of 8.96 g. In SI units the density may be expressed in kilogrammes per cubic metre (kg m^{-3}). In the case of gases density is usually shown as g dm^{-3} (g l^{-1}) at s.t.p. —DENSE (*adj.*) ↓ SPECIFIC GRAVITY · VAPOUR DENSITY[1] ↑ MACROSCOPIC PROPERTIES

BA027 relative density[2] (*n.*) The ratio of the mass of any volume of a substance to the mass of an equal volume of water at a stated temperature:

$$\text{relative density} = \frac{\text{mass of given volume of substance}}{\text{mass of an equal volume of water}}$$

↑ DENSITY[2]

BA028 specific gravity (*n.*) An obsolete name for RELATIVE DENSITY[2]

BA029 vapour density[1] (*n.*) The density of a gas or vapour divided by the density of hydrogen, *e.g.*

density of CO_2 at s.t.p. = 1·97 g dm^{-3}

density of H_2 at s.t.p. = 0·089 g dm^{-3}

vapour density of CO_2 = 1·97/0·089 = 22. ↑ DENSITY[2]

BA030 dense[1] (*adj.*) **1** Closely packed. **2** Having a density greater than that of water; the term is used in the **denser** form, *e.g.* ***a*** carbon dioxide is denser than air; ***b*** gold is denser than copper. It is also used in the converse **less dense** form, *e.g.* ***a*** sodium is less dense than water; ***b*** hydrogen is less dense than air. ↓ ELASTIC[2] ↑ MACROSCOPIC PROPERTIES

BA031 elastic[2] (*adj.*) Describes a substance which can recover its original shape after distortion, *e.g.* rubber is elastic. —ELASTICITY (*n.*) ↑ DENSE[1]

BA032 microscopic properties (*n.pl.*) Those underlying and invisible properties which cause the easily observable macroscopic properties, *e.g.* the form of bonding in a compound which will determine behaviour with an electric current and melting point. ↑ PHYSICAL PROPERTY

Chemical Technique

BB001 chemical technique (*n.*) A chemical technique includes the knowledge of the appropriate branch of chemistry together with the necessary mechanical or manipulative skills to carry on activity in that subject. *E.g.* ***a*** The technique of extraction in organic chemistry involves a knowledge of miscibility of liquids, such as ether and water, and the solubilities of solids in water and other solvents, such as phenol in water and ether. ***b*** The technique of separation requires knowledge of the properties of the substances to be separated as well as the skills involved. Thus the separation of ethene (C_2H_4) and ethyne (C_2H_2) and ethane (C_2H_6) requires the knowledge that ethene forms an addition compound with bromine, and that ethyne forms a compound with silver, whereas ethane does not. The manipulative skills in handling gases are also needed. ↓ GENERATOR[2] · FILTRATION · DISTILLATION · ANALYSIS · GRADUATION · REPLACE[2] · ISOLATE · REFINED · VOLUMETRIC · DISTILLING → PROCESS[3] · PHYSICAL PROPERTY

BB002 generator[2] (*n.*) Any apparatus which will produce or make a named gas in quantity. Gas generators can be used for making CO_2, H_2S and H_2. —GENERATE (*v.*) GENERATION (*n.*) ↓ BOIL[2] · ACIDIFICATION · NEUTRALIZATION[1] · SEPARATION · GENERATING VESSEL · BUMPING → CHEMICAL TECHNIQUE

BB003 generation[1] (*n.*) The process of producing or forming gases, *e.g.* the generation of hydrogen sulphide is usually carried out in a Kipps apparatus. —GENERATE (*v.*) GENERATOR (*n.*) ↑ GENERATOR[2]

BB004 boil[2] (*n.*) The state of a liquid which is boiling; the state of a liquid when it is boiled □ *the water is on the boil; we brought the liquid to the boil before adding the solid; add the solid when the water comes to the boil, do not let the water go off the boil.* —BOIL (*v.*) BOILING, BOILED (*adj.*) ↑ GENERATOR[2] → BOILING POINT

BB005 acidification (*n.*) The process of

making a solution acid, *i.e.* having a H^+ concentration greater than 10^{-7} moles per dm^3 (litre) or showing an acid reaction to indicators. —***acidify*** (*v.*) ACID (*n.*) ***acid*** ACIDIC (*adj.*) ↑ GENERATOR[2]

BB006 neutralization[1] (*n.*) The process of making a solution neutral, *e.g.* the neutralization of an acid by an alkali, by a carbonate (solid or in solution), or by a base. —NEUTRALIZE (*v.*) NEUTRAL (*adj.*) ↑ GENERATOR[2] → ACID · BASE[3] · ALKALI · PH

BB007 separation (*n.*) A process by which substances are separated, *e.g.* ***a*** crystals are separated from mother liquor; ***b*** distillation is a process of separation of two or more liquids. —SEPARATE (*v.*) SEPARABLE (*adj.*) ↑ GENERATOR[2]

BB008 generating vessel (*n.*) Usually a flask in which a gas or recoverable product is being formed. ↑ GENERATOR[2]

BB009 bumping (*n.*) In a liquid at its boiling point some parts of the liquid are at a higher temperature than the boiling point. Formation of bubbles of vapour should begin but will not do so unless there are nuclei for the bubbles to form on. When they do form the pressure inside will be high and the bubble will expand rapidly causing the whole liquid and container to jump up. Pieces of broken porcelain or porous pot will stop bumping by providing nuclei. —***bump*** (*v.*) ↑ GENERATOR[2]

BB010 filtration (*n.*) A process for separating a solid from a liquid when the two are mixed and the solid is insoluble in the liquid. The mixture is passed through a porous material. In the laboratory this is usually a filter paper. For coarse filtration glass wool can be used, especially if the liquid is corrosive. Specially prepared filters of sintered glass are also used for accurate work. Beds of sand are used for filtering water for the public supply. —FILTER (*v.*) FILTER, FILTRATE (*n.*) ↓ FILTRATE · RESIDUE · DECANTATION · SUPERNATANT LIQUID · FRACTIONAL CRYSTALLIZATION · SUBLIMATION · MOTHER LIQUOR ↑ CHEMICAL TECHNIQUE

BB011 filtrate (*n.*) The liquid part of a mixture which passes through the filter paper or other porous material during filtration. —FILTER (*v.*) FILTRATION, FILTER (*n.*) ↑ FILTRATION

BB012 residue (*n.*) Solid material left behind after some process, *e.g.* ***a*** after filtration, *i.e.* on the filter paper or other filter; ***b*** after distillation, *i.e.* the residue in the distilling flask; ***c*** after decantation; ***d*** after evaporation. —***residual*** (*adj.*) ↑ FILTRATION

BB013 decantation (*n.*) The process of pouring off a liquid from a solid sediment. The process is often carried out when the solid has to be washed. Decantation implies that a precipitate has settled onto the bottom of the vessel. —DECANT (*v.*) ↑ FILTRATION

BB014 supernatant liquid (*n.*) The liquid which stands in a vessel above a settled precipitate or sediment. It is the liquid which is poured off during decantation. ↑ FILTRATION

BB015 fractional crystallization (*n.*) A process suitable for separating substances with solubilities of nearly the same value. It involves a series of recrystallizations separating crystals and mother liquor. At each stage the crystals will be enriched in one component and the mother liquor will be enriched in the other component. Mme Curie separated radium bromide and barium bromide in this way. ↑ FILTRATION

BB016 sublimation (*n.*) A process in which a solid changes directly to a vapour, without first forming a liquid. Carbon dioxide and iodine are examples of solids that undergo sublimation. —SUBLIME (*v.*) ***sublimed*** (*adj.*) ↑ FILTRATION

BB017 mother liquor (*n.*) The liquid (solution) remaining after crystals have formed. ↑ FILTRATION

BB018 distillation (*n.*) The process of converting a liquid into a vapour and then condensing the vapour back to a liquid. Usually the process is used as a method of purification or of separation of two liquids. —DISTIL (*v.*) DISTILLING (*adj.*) ***distillate*** (*n.*) ↓ FRACTIONAL DISTILLATION · DRY DISTILLATION · VACUUM DISTILLATION · STEAM DISTILLATION · DESTRUCTIVE DISTILLATION · FRACTIONATING COLUMN · FRACTION

BB019 fractional distillation (*n.*) A process of distillation carried out using a special neck or extension to a distilling flask to enable separate portions (fractions) of different volatility to be collected at different temperatures. ↑ DISTILLATION

BB020 dry distillation (*n.*) A process of heating a solid to form a vapour which distils over, *e.g.* the preparation of propanone (acetone) by dry distillation of calcium ethanoate (acetate). ↑ DISTILLATION

BB021 vacuum distillation (*n.*) Distillation under reduced pressure, thus reducing the boiling point of the substance. This is a method which is useful for substances which decompose at temperatures below their boiling point at atmospheric pressure. ↑ DISTILLATION

BB022 steam distillation (*n.*) The distillation of a liquid which is immiscible with water by blowing steam through the heated liquid. The vapour of the liquid and the steam pass together into the condenser so that the liquid and water are collected together, *e.g.* aniline can be steam distilled. ↑ DISTILLATION

BB023 destructive distillation (*n.*) The process of heating organic solids or liquids to such temperatures that decomposition results, with the production of a residue (solid or viscous liquid) and a distillate, sometimes with a gas as well, *e.g.* destructive distillation of coal leaves coke as a residue. The distillate contains several fractions and coal gas and ammonia are also produced. ↑ DISTILLATION

BB024 fractionating column (*n.*) An extension added to the neck of a distilling flask so

that partial condensation of vapour may occur at a number of points. This leads to the enrichment of less volatile constituents in the condensate and enrichment of the more volatile constituents in the vapour. ↑ DISTILLATION

BB025 fraction (*n.*) A portion of distillate collected during fractional distillation, *e.g.* the fraction collected between 90°C and 95°C. —FRACTIONATE (*v.t.*) ***fractionation*** (*n.*) ↑ DISTILLATION

BB026 analysis (*n.*) A process or processes by which the identity of a substance, the composition of a mixture, the constituents and structure of a compound, or the concentration of a solution may be determined □ *a chemist carries out an analysis* —***analyse*** (*v.*) ***analytical*** (*adj.*) ↓ SYNTHESIS · QUANTITATIVE ANALYSIS · QUALITATIVE ANALYSIS · VOLUMETRIC ANALYSIS · GRAVIMETRIC ANALYSIS · PURIFICATION · SEMI-MICRO METHOD · PURITY ↑ CHEMICAL TECHNIQUE

BB027 synthesis (*n.*) **1** The building up of a compound, by chemical processes, starting from its elements, *e.g.* making ammonia from nitrogen and hydrogen is a synthesis. **2** The building up by laboratory processes of a compound usually found in a natural form. Vitamin B and indigo dye are examples of natural compounds obtained by synthesis. —***synthesize*** (*v.*) SYNTHETIC (*adj.*) ↑ ANALYSIS

BB028 quantitative analysis (*n.*) The determination by accurate measurement of the composition by mass (**gravimetric**) or by volume (**volumetric**), of samples of chemical substances. Quantitative analysis shows how much of the substance is present. ↑ ANALYSIS ↓ VOLUMETRIC ANALYSIS · GRAVIMETRIC ANALYSIS

BB029 qualitative analysis (*n.*) The determination of the chemical composition of a sample of material, using chemical tests or physical methods of detection. Qualitative analysis of a substance shows what compound it is or what chemicals it contains. ↑ ANALYSIS

BB030 volumetric analysis (*n.*) A method of analysis which uses solutions of known concentration, *i.e.* standard solutions for titration against solutions of unknown concentrations. The reactions may be of a number of different kinds. Concentrations may be given in g dm^{-3} or mol dm^{-3}. They may also be expressed as molarity and as M value, *e.g.* 1M; 0.1M. ↑ ANALYSIS

BB031 gravimetric analysis (*n.*) A method of analysis which depends upon precipitation and weighing of precipitates, *e.g.* the percentage of silver in a sample of ore may be determined by a gravimetric method involving the precipitation of silver chloride. ↑ ANALYSIS

BB032 purification (*n.*) A general term for the various processes by which a pure substance is isolated at the end of a preparation, as a final process in extraction of an element or manufacture of a substance, *e.g.* ***a*** the purification of metallic copper by electrolysis using impure copper as the anode; ***b*** the purification of hydrogen peroxide by distillation under reduced pressure. —PURIFY (*v.t.*) PURE (*adj.*) ↑ ANALYSIS

BB033 semi-micro method (*n.*) A method of analysis or preparation using small quantities of materials and small-scale apparatus. ↑ ANALYSIS

BB034 purity (*n.*) This term has a rather special meaning in chemistry. It accepts the fact that 100% purity must be a rare attainment – that very small amounts of impurity will usually be present. The purity (*i.e.* percentage purity) is usually given on a container by the supplier. An A.R. reagent is guaranteed a high degree of purity suitable for certain analytical purposes. Technical and commercial chemicals are for coarse work, *i.e.* agricultural salt or technical copper sulphate. Pharmaceutical standards of purity are laid down for chemicals used as medicines. —PURIFY (*v.*) PURIFICATION (*n.*) PURE (*adj.*) ↑ ANALYSIS

BB035 graduation (*n.*) One of the equally spaced marks made on a vessel or other piece of apparatus to show a scale of measurement. ↓ TITRATION · TITRATION VALUE · TITRE ↑ CHEMICAL TECHNIQUE

BB036 titration (*n.*) The process of running one solution into another solution to achieve a point at which reaction between the solutions is complete, in such a way that the volumes of the two solutions may be known. Titrations can be carried out with acid-alkali reactions and redox reactions. —***titrate*** (*v.*) ↑ GRADUATION · VOLUMETRIC ANALYSIS · NEUTRALIZATION[1]

BB037 titration value (*n.*) The value in cm^3 of the amount of a solution delivered by a burette during titration. ↑ GRADUATION · VOLUMETRIC ANALYSIS

BB038 titre (*n.*) The volume of solution run from a burette during a titration. ↑ GRADUATION

BB039 replace[2] (*v.t.*) To substitute one group or atom by another in a chemical reaction, *e.g.* one of the hydrogen atoms of methane is replaced by an —OH group to form methanol. This is an imaginary process in this case as the replacement does not take place directly. The term is also used of replacement of hydrogen in acids by metals. —***replacement*** (*n.*) ***replaceable*** (*adj.*) ↓ GENERATE · BUBBLE[4] · BOIL[3] · DISTIL · FRACTIONATE · DECANT · FILTER[3] · SUBLIME ↑ CHEMICAL TECHNIQUE

BB040 generate (*v.t.*) To produce a gas by a chemical reaction. —GENERATION (*n.*) GENERATOR (*n.*) ↑ REPLACE[2]

BB041 bubble[4] (*v.t.*) To cause a stream of bubbles to pass through a liquid, *e.g.* air is passed through (bubbled through) a solution of sodium hydroxide to remove carbon dioxide. —BUBBLE (*n.*) ***bubbling*** (*n.*) ↑ REPLACE[2]

BB042 boil[3] (*v.t.,i.*) **1** (*v.t.*) To heat a liquid to its boiling point and to maintain it at that temperature. **2** (*v.i*) (Of a liquid) to

undergo the process of boiling; to change from a liquid to a vapour at the boiling point. —BOILING (*adj.*) BOIL (*n.*) BOILING (*n.*) ↑ REPLACE[2] → BOILING POINT

BB043 distil (*v.t.,i.*) **1** (*v.t.*) To heat a liquid so that it undergoes the process of distillation; to separate a mixture by distillation. **2** (*v.i.*) (Of a liquid) to undergo distillation. —DISTILLATION, ***distillate*** (*n.*) DISTILLING (*adj.*) ↑ REPLACE[2]

BB044 fractionate (*v.t.*) To separate by fractional distillation. —FRACTION, ***fractionation*** (*n.*) ↑ REPLACE[2]

BB045 decant (*v.t.*) To pour off a liquid to leave an undisturbed sediment, *e.g.* after precipitating barium sulphate from solution it is allowed to settle; the liquid above the settled precipitate is then poured off: the liquid is decanted. —***decantation*** (*n.*) ↑ REPLACE[2]

BB046 filter[3] (*v.t.*) To pour a mixture of a liquid and an insoluble solid through a filter (filter paper, glass wool, sintered glass filter, etc.) to separate the liquid from the solid. —FILTRATION (*n.*) FILTER (*n.*) ***filtered*** (*adj.*) ↑ REPLACE[2]

BB047 sublime (*v.t.,i.*) **1** (*v.i.*) To change from the solid state to the gaseous state directly, *e.g.* iodine sublimes when heated. **2** (*v.t.*) To cause to change from solid to gas directly. —SUBLIMATION (*n.*) ***sublimed*** (*adj.*) ↑ REPLACE[2] → CHANGE OF STATE

BB048 isolate (*v.t.*) To obtain an element from one of its compounds or to separate a pure substance from a mixture of substances (or from a mineral or ore), *e.g.* Mme Curie separated radium bromide from barium bromide in her isolation of radium. —ISOLATION (*n.*) ***isolating*** (*adj.*) ↓ REFINE[2] · PURIFY · NEUTRALIZE · BLEACH[1] ↑ CHEMICAL TECHNIQUE

BB049 refine[2] (*v.t.*) **1** To remove impurities or coarse parts from a substance or to separate the various parts of a mixture, *e.g.* to refine sugar, to refine oil. **2** To make something more efficient, more delicate, more accurate, *e.g.* ***a*** a more refined method of finding the composition of the air; ***b*** a more refined apparatus for determining the osmotic pressure of a solution. —***refining*** (*n.*) REFINED (*adj.*) ***refinery*** (*n.*) ↑ ISOLATE

BB050 purify (*v.t.*) To make pure by removing impurities, *e.g.* ***a*** to purify ethanol, its main impurity, water, must be removed; this is done by fractional distillation, drying over calcium oxide, and final distillation from calcium metal; ***b*** commercial copper sulphate is purified by crystallization. —***purification***, PURITY (*n.*) PURE, ***purified*** (*adj.*) ↑ ISOLATE

BB051 neutralize (*v.t.*) To make neutral. To balance the concentration of H^+ or OH^- so that a solution is neither acid nor alkaline. A base (CuO), a carbonate ($CuCO_{3(s)}$), $Na_2CO_{3(aq)}$, or an alkaline solution, may be added to a solution of sulphuric acid to neutralize it. ↑ ISOLATE

BB052 bleach[1] (*v.t.*) To remove colour from. The term has a similar meaning to **decolorize.** It is normally used of materials which carry a coloured substance which is acted upon by the bleach (a bleaching liquid or gas), *e.g.* ***a*** litmus paper is bleached by chlorine – litmus paper is an absorbent white paper carrying either blue or red litmus (azolitmin); the chlorine acts with the azolitmin; ***b*** straw is cellulose with a yellow colouring – sulphur dioxide reacts with the yellow colouring, changing it to a colourless compound. In contrast, sulphur dioxide decolorizes potassium manganate (VII) in a direct reaction between MnO_4^- (coloured) and SO_2 to form Mn^{2+} (colourless). Bleaching usually leaves the material white or near white. Decolorization leaves the substance colourless. —***bleach*** (*n.*) ***bleaching, bleached*** (*adj.*) ↑ ISOLATE

BB053 refined (*adj.*) **1** (Of a material) purified. **2** (Of a piece of apparatus or a technique), allowing more precise and accurate measurements to be made, more delicate work to be done, etc. ↓ BOILED · PURE · PURIFIED · APPRECIABLE[2] · LIMITED[2] · PLENTIFUL[2] · EXCESS[3] · ACIDIFIED ↑ CHEMICAL TECHNIQUE

BB054 boiled (*adj.*) Describes a liquid (usually water) which has been through the process of boiling. For water this indicates that the liquid has been freed from dissolved gases. —BOIL (*v.*) ↑ REFINED

BB055 pure (*adj.*) Applied to an element or compound which is made up of, ***a*** only atoms of the element; ***b*** only ions or molecules of the compound, *e.g.* ***a*** pure gold is a sample of gold which does not contain any other element; ***b*** a sample of pure water (*i.e.* chemically pure water) should contain only molecules of H_2O. Such extreme conditions are rarely attained but a percentage purity is usually stated for a chemical substance according to its use. —PURITY (*n.*) PURIFY (*v.*) ***purified*** (*adj.*) ↑ REFINED → IMPURE (I) · CONTAMINATED[1] (I)

BB056 purified (*adj.*) Describes a substance which has undergone a number of processes to make it pure. ↑ REFINED

BB057 appreciable[2] (*adj.*) Large or important enough to be taken into account, *e.g.* chlorine is better collected over hot water because of the appreciable solubility of the gas in cold water. ↑ REFINED

BB058 limited[2] (*adj.*) Describes the state of one of the substances in a reaction when there is not enough of the substance present. Thus, when carbon burns in a limited supply of air, carbon monoxide is formed. When carbon is burned in a plentiful supply of air, carbon dioxide is formed. ↑ REFINED

BB059 plentiful[2] (*adj.*) Describes a substance, the quantity of which is more than is needed for the purpose, *e.g.* a substance heated in a plentiful supply of oxygen. —***plenty*** (*n.*) ↑ REFINED

BB060 excess[3] (*adj.*) More than is necessary or required. The term is always used attributively, *e.g.* the oxygen not taken up in a reaction is excess oxygen —***excess*** (*n.*)

↑ REFINED

BB061 acidified (*adj.*) Describes a solution to which an acid has been added so that there is an excess of hydrogen ions (H^+). —***acidify*** (*v.*) ACIDIFICATION (*n.*)↑ REFINED

BB062 volumetric (*adj.*) Involving the use of volumes. Volumetric methods of chemical investigation are methods which use exactly measured volumes of solutions of known concentrations. ↓ GRAVIMETRIC (Cm) · GRADUATED · CALCINED · STOUT-WALLED · THIN-WALLED ↑ CHEMICAL TECHNIQUE · ANALYSIS

BB063 gravimetric (*adj.*) Involving the use of weighing. Gravimetric methods of chemical investigation are methods which use measurement of masses of reactants and products. A gravimetric analysis tries to separate the constituents of a mixture or a compound in order to find the masses of the constituents. ↑ VOLUMETRIC

BB064 graduated (*adj.*) Marked to receive or deliver a stated volume of liquid or gas. Examples of graduated vessels include the burette, pipette, measuring cylinder and measuring flask. The term is also applied to a piece of apparatus marked with a scale, *e.g.* a thermometer is graduated in degrees. —***graduate*** (*v.*) GRADUATION (*n.*) ↑ VOLUMETRIC · VOLUMETRIC ANALYSIS · GRADUATION

BB065 calcined (*adj.*) Describes a substance that has been heated to a high temperature to drive off volatile substances or to cause oxidation of metals. A powder (or calx) is the product. —***calcine*** (*v.*) ↑ VOLUMETRIC → FUSED[1]

BB066 stout-walled (*adj.*) Having a wall made of strong material to withstand pressure. Liquid sulphur dioxide is stored in stout-walled glass siphons (bottles). ↑ VOLUMETRIC

BB067 thin-walled (*adj.*) Describes flasks, test tubes, etc., made of very thin glass. Thin-walled vessels can withstand changes in temperature when they are heated. ↑ VOLUMETRIC

BB068 distilling (*adj.*) Describes apparatus used in distillation, *e.g.* a distilling flask. —DISTIL (*v.*) DISTILLATION, ***distillate*** (*n.*) ↓ SEPARATING ↑ FRACTIONATE · DISTIL · CHEMICAL TECHNIQUE

BB069 separating (*adj.*) Describes a piece of apparatus used in separation. A separating funnel is a piece of apparatus used for separating immiscible liquids. —SEPARATE (*v.*) SEPARATION (*n.*) ↑ DISTILLING

BB070 screen[2] (*n.*) A mesh of wire for separating coarser particles from finer particles. → SOLID[2]

BB071 chemical reaction (*n.*) A process in which a chemical change takes place. It is marked by the production of a new substance, or substances, and by energy changes. ↓ REACTION[2]

BB072 reaction[2] (*n.*) A process in which two substances undergo mutual change in structure and energy content. ↓ REACTANT · REAGENT · PRODUCT[2] · ACTION[3] ↑ CHEMICAL REACTION

BB073 reactant (*n.*) One of the substances involved in a chemical reaction, *e.g.* dilute sulphuric acid and zinc are the reactants in a reaction for the making of zinc sulphate and hydrogen. ↑ REACTION[2]

BB074 reagent (*n.*) A substance which added to another or other substances causes a chemical reaction, *e.g.* bromine is a reagent which when added to ethene causes a chemical reaction, forming 1, 2-dibromoethane. Reagents are of two types, **electrophilic** and **nucleophilic.** ↑ REACTION[2]

BB075 product[2] (*n.*) A substance that results from a chemical reaction, *e.g.* when dilute sulphuric acid and zinc react, one of the products is hydrogen. ↑ REACTION[2]

BB076 action[3] (*n.*) The effect of one substance upon another, *e.g.* the action of zinc on dilute sulphuric acid produces hydrogen. ↑ REACTION[2]

BB077 react (*v.i.*) To behave in such a way with another substance so that there are energy changes and new substances are formed, *e.g.* bromine and ethene react to form 1, 2-dibromoethane (bromine reacts with ethene to form 1, 2-dibromoethane) □ *to react with another substance* —REACTION, ***reactant,*** REACTIVITY, ***reactance, reactor*** (*n.*) ***reactive*** (*adj.*) ↓ ACT ON · COMBINE · TREAT[1] ↑ CHEMICAL REACTION

BB078 act on (*v.t.*) To behave in such a way to another substance that a change takes place in its structure and its internal energy, *e.g.* zinc acts on dilute sulphuric acid, forming hydrogen. ↑ REACT

BB079 combine (*v.i.*) (Of elements) to join by forming bonds; (of compounds) to form by addition, *e.g.* ***a*** sodium and chlorine combine by the formation of ionic bonds between their atoms; ***b*** hydrogen and chlorine combine with the formation of covalent bonds; ***c*** ethene and bromine combine by addition, forming 1, 2-dibromoethane. —COMBINATION (*n.*) COMBINED (*adj.*) ↑ REACT

BB080 treat[1] (*v.t.*) To add a reagent, a solution, or a liquid, to another substance so as to cause a chemical change, *e.g.* an ammonium salt is treated with sodium hydroxide solution to obtain ammonia gas. ↑ REACT

BB081 process[2] (*n.*) A set of operations for the manufacture, preparation, or isolation, of compounds, *e.g.* ***a*** the Haber process for the manufacture of ammonia; ***b*** the preparation of ethyl ethanoate includes the processes of refluxing the reactants, distilling the products, and purifying the final product. —PROCESS (*v.*) ↓ HEAVY CHEMICAL · RAW MATERIALS · OIL/FROTH FLOTATION · BLAST FURNACE · TECHNICAL · HABER PROCESS · BOSCH PROCESS · TONNAGE OXYGEN · COAT[1] · CRACKING · VULCANIZATION · DYE ↑ CHEMICAL TECHNIQUE → MANUFACTURE

BB082 heavy chemical (*n.*) An essential chemical needed for industry, *e.g.* sulphuric acid used in the paint industry and in the making of detergents; sodium carbonate

and sodium sulphate used in glass making; nitric acid for fertilizers and in the manufacture of explosives. ↓ FINE CHEMICAL · PHARMACEUTICAL CHEMICAL ↑ PROCESS[2]

BB083 fine chemical (*n.*) A chemical manufactured for special use, even in small quantities. Such chemicals are usually very pure, *e.g.* analytical reagents are fine chemicals. ↑ HEAVY CHEMICAL

BB084 pharmaceutical chemical (*n.*) A substance of natural or synthetic origin used for medicinal purposes. ↑ HEAVY CHEMICAL

BB085 raw materials (*n.pl.*) Materials and substances which form the starting point for the manufacture of pure and refined substances or materials, *e.g.* the raw materials necessary for the manufacture of iron are iron ore, coke and limestone. ↓ BY-PRODUCT · WASTE PRODUCT ↑ PROCESS[2]

BB086 by-product (*n.*) A substance produced during the manufacture of another substance, *e.g.* sodium hydroxide is produced as a by-product during the manufacture of chlorine by the electrolysis of brine. ↑ RAW MATERIALS

BB087 waste product (*n.*) Unwanted products that are produced in an industrial chemical process, *e.g.* slag from the extraction of iron is a waste product. Some waste products are converted to useful substances, or important elements in the waste product are recovered. ↑ RAW MATERIALS

BB088 smelting (*n.*) The melting of an ore together with a chemical change such that the constituents of the liquid mix are different from those at the start of the process, *e.g.* tin (IV) oxide (SnO_2) melts at 1130°C; mixed with coke (carbon), reduction takes place and molten tin (m.p. 232°C) is formed. —***smelt*** (*v.*) → MANUFACTURE

BB089 clinker (*n.*) The hard fusible mass of non-combustible material found at the bottom of a boiler fire. It consists of earthy material – mainly silica and silicates fused together. ↑ SMELTING → MANUFACTURE

BB090 extraction[1] (*n.*) The process by which an element is obtained from the earth's crust, either as the element, *e.g.* gold and sulphur, or by way of one of its ores, *e.g.* copper from copper pyrites. —EXTRACT (*v.*) ↑ SMELTING → MANUFACTURE · ORE · MINERAL

BB091 slag (*n.*) The waste product from the blast furnace in the extraction of iron. It consists mainly of calcium silicate formed by the reaction of calcium oxide with the acidic earthy material in the iron ore. ↑ SMELTING

BB092 plant[2] (*n.*) The collection of buildings, machinery and devices which are used for the manufacture of some chemical, device, material or product, *e.g.* the plant for producing sulphuric acid by the contact process. ↓ FROTH FLOTATION · OIL/FROTH FLOTATION ↑ PROCESS[2]

BB093 froth flotation (*n.*) See OIL/FROTH FLOTATION. ↓ OIL/FROTH FLOTATION ↑ PROCESS[2]

BB094 oil/froth flotation (*n.*) A process of separation used industrially, especially for the concentration of sulphide ores by the formation of a stable foam in which the particles collect in the liquid-air interfaces of the bubbles. **Frothing agents** are added to stabilize the foam. **Collectors** are used to vary the wetting behaviour on the surface of the sulphides. **Activators and depressors** make the action of collectors more selective and so enable specific separations to be made. ↑ PROCESS[2]

BB095 blast furnace (*n.*) A vertical furnace through which a blast (strong current) of air or gas passes, *e.g.* iron is extracted from iron ore in a blast furnace. At the correct temperature, the air blast produces carbon monoxide to reduce the iron oxide. ↓ REVERBERATORY FURNACE ↑ PROCESS[2]

BB096 reverberatory furnace (*n.*) A furnace with a shallow hearth with a low arched roof from which the heat of reaction is reflected down on to the reactants. ↑ BLAST FURNACE

BB097 concentrate[1] (*n.*) **1** A concentrated material, such as lime juice, which will later be diluted with water. **2** The result of concentration, *e.g.* in the extraction of lead from its ore, galena, the required active constituent lead sulphide, PbS, is made a concentrate by oil flotation. —CONCENTRATE (*v.*) CONCENTRATION (*n.*) CONCENTRATED (*adj.*) → CONCENTRATE[2]

BB098 recover[1] (*v.t.*) To purify and use again one or more of the waste products of an industrial chemical process. ↑ PROCESS[2]

BB099 technical (*adj.*) Describes a grade of purity for chemicals between coarse and pharmaceutical. Technical chemicals are usually adequate for demonstration purposes but are not adequate for analytical purposes. ↓ SPENT · CONTAMINATED[1]

BB100 spent (*adj.*) Used up; having the essential constituent removed or replaced so that what is left no longer performs its original function, *e.g.* ***a*** spent oxide is the material left after iron (III) oxide has been used to purify coal gas by removing sulphur compounds: it contains such a high percentage of sulphur as to be no further use; ***b*** spent acid is a liquid in which the acid content has been reduced beyond the point of usefulness for the specific purpose, *e.g.* the weak acid left in a Kipps apparatus after use for some time. ↑ TECHNICAL

BB101 contaminated[1] (*adj.*) Containing a small quantity of an impurity. —CONTAMINATE (*v.*) CONTAMINATION (*n.*) ↑ TECHNICAL · PURE

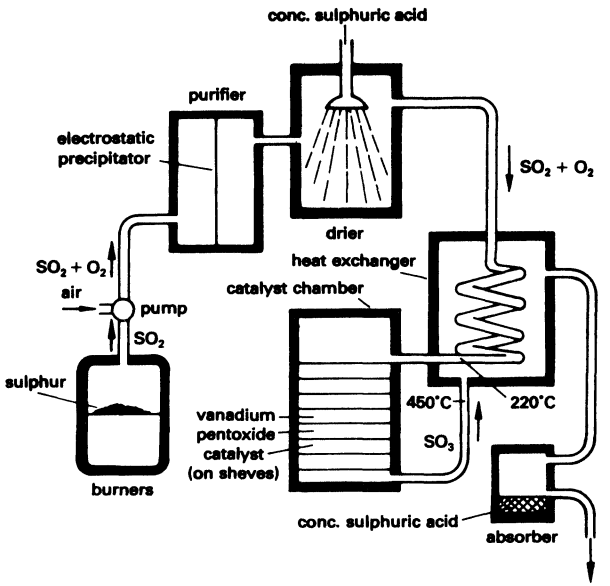
BB102 Haber process (*n.*) A process for the manufacture of ammonia by synthesis from nitrogen and hydrogen. Three parts of hydrogen and one part of nitrogen at a pressure of 250 to 1000 atmospheres are passed over a catalyst of iron mixed with promoters, such as aluminium oxide, at a temperature of 500°C. The ammonia is separated as a liquid and the remaining gases are recirculated. ↓ CONTACT PROCESS · SOLVAY PROCESS

BB103 contact process (*n.*) A process for the manufacture of sulphuric acid by first

making sulphur trioxide and absorbing it in concentrated sulphuric acid. This forms $H_2S_2O_7$, fuming sulphuric acid. On reaction with water sulphuric acid is formed.

$$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$$
$$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$$

The sulphur trioxide is obtained by passing SO_2 and excess air, both purified and dried, over a catalyst of vanadium pentoxide (V_2O_5) at 500°C. ↑ HABER PROCESS



CONTACT PROCESS

BB104 Solvay process (*n.*) A process used for the manufacture of sodium carbonate decahydrate. A saturated solution of sodium chloride is saturated with ammonia gas. The cooled liquid is passed down a column against a rising current of carbon dioxide. Sodium hydrogen carbonate (only slightly soluble in *cold* water) is precipitated. The sludge is heated to form a crude sodium carbonate. This is then recrystallized to give the sodium carbonate decahydrate. The overall equation is:

$$H_2O + NaCl + NH_3 + CO_2 \rightarrow NaHCO_3 \downarrow + NH_4Cl$$

↑ HABER PROCESS

BB105 Deacon process (*n.*) A method formerly used for the manufacture of chlorine by oxidation of hydrogen chloride with air over a catalyst of copper (II) chloride. Because hydrogen chloride is now readily available as a by-product the process has been revived. Better conversion has been obtained by using a copper catalyst containing one or more rare-earth chlorides on a silica gel support. ↑ HABER PROCESS

BB106 Bosch process (*n.*) A process using water gas for making hydrogen. The water gas is mixed with steam and passed over a catalyst of iron with traces of chromium (III) oxide as a promoter at 450°C. This latter reaction is:

$$CO + H_2O \rightleftharpoons CO_2 + H_2$$

There are a number of methods of removing the carbon dioxide. The one frequently used is washing the gases with hot potassium carbonate solution under pressure. Instead of water gas it is now more usual to use a mixture of methane (natural gas) and steam passed over a nickel catalyst at 900°C. Naphtha and steam with nickel at 800°C is also used. ↓ WATER-GAS SHIFT REACTION · LEAD CHAMBER PROCESS · GOSSAGE PROCESS ↑ PROCESS[2]

BB107 water-gas shift reaction (*n.*) The conversion of a mixture of carbon monoxide and hydrogen into carbon dioxide and more hydrogen by adding steam and using a catalyst of iron (III) oxide:

$$H_2 + CO + H_2O \rightleftharpoons CO_2 + 2H_2.$$

↑ BOSCH PROCESS

BB108 lead chamber process (*n.*) A process for the manufacture of sulphuric acid by oxidizing sulphur dioxide and water using nitrogen monoxide as an oxygen carrier. The reactions are:

$$2NO + O_2 \rightarrow 2NO_2$$
$$H_2O + SO_2 + NO_2 \rightarrow H_2SO_4 + NO$$

The layout of the process is designed to avoid loss of reaction products. ↑ BOSCH PROCESS

BB109 Gossage process (*n.*) A process for the manufacture of sodium hydroxide by

boiling a suspension of calcium hydroxide in water with sodium carbonate in solution. The calcium carbonate is filtered off and the filtrate evaporated. This process has been replaced by the Kellner-Solvay process. It is used sometimes when sodium carbonate is formed in an industrial process and can be recycled for use again as sodium hydroxide. ↑ BOSCH PROCESS

BB110 Kellner-Solvay process A method for the manufacture of sodium hydroxide by the electrolysis of brine (concentrated sodium chloride solution) using a mercury cathode. Chlorine is formed at the anode. This substance, which was once a by-product, has now become an important product, and the process is commonly used for the manufacture of chlorine. ↑ BOSCH PROCESS

BB111 tonnage oxygen (*n.*) Oxygen used in the manufacture of steel, so called because it is used in such large quantities that it is measured in tonnes. ↓ FUMIGATION[1] · WATER GAS · SYNTHESIS GAS · TINNING → PROCESS[2]

BB112 fumigation[1] (*n.*) The process of filling a room, etc, with fumes to destroy bacteria or vermin. Poisonous gases are usually used for this purpose. —***fumigate*** (*v.*) ↑ TONNAGE OXYGEN → BACTERIA · VERMIN

BB113 water gas (*n.*) A mixture of carbon monoxide and hydrogen obtained by passing steam over white-hot coke. It is a useful fuel gas and can be used as a starting point for the manufacture of hydrogen. ↑ BOSCH PROCESS · TONNAGE OXYGEN

BB114 synthesis gas (*n.*) The mixture of carbon monoxide (CO) and hydrogen (H_2) formed when methane (CH_4) and steam are passed over a nickel catalyst at 700°C. The reaction is:

$$CH_{4(g)} + H_2O_{(g)} \rightarrow CO_{(g)} + 3H_{2(g)}$$

The mixture can be used for the manufacture of hydrogen by addition of more steam and an iron (III) oxide catalyst at 300°C which converts carbon monoxide and steam to hydrogen and carbon dioxide:

$$CO_{(g)} + H_2O_{(g)} \rightarrow CO_2 + H_2$$

By adjusting the proportions of carbon monoxide and hydrogen and using a catalyst of ZnO (zinc oxide) at 300°C, methanol can be obtained:

$$CO_{(g)} + 2H_{2(g)} \rightarrow CH_3OH_{(l)}$$

↑ TONNAGE OXYGEN

BB115 tinning (*n.*) A process for putting a very thin coating of tin on to the surface of iron to protect the iron from rusting. —TIN (*v.*) ***tin*** (*n.*) ↑ TONNAGE OXYGEN

BB116 coat[1] (*v.t.*) To cover with a thin outer layer of some material. —***coat,*** COATING (*n.*) ***coated*** (*adj.*) ↓ GALVANIZE · SHERARDIZE · TIN → PROCESS[2] · LAYER · JACKET

BB117 galvanize (*v.t.*) To cover a metal (usually iron) with a very thin layer of zinc by dipping iron sheets into molten zinc. —***galvanized*** (*adj.*) ↑ COAT[1]

BB118 sherardize (*v.t.*) To coat an article of iron or other metals with a coating of zinc by heating the articles in a closed vessel with zinc dust. The temperature is slightly below the melting point of zinc. ↑ COAT[1]

BB119 tin (*v.t.*) To cover a sheet of iron with a coating of tin. The sheet of iron is treated to clean the surface; it is then dipped into a bath of molten tin. ↑ COAT[1]

BB120 cracking (*n.*) The decomposition by heat of a petroleum fraction into substances of lower molecular weight. Sometimes a catalyst is used. —CRACK (*v.*) ↓ RECYCLING · EXTRACTION[2] · SALTING OUT → PROCESS[2] · FRACTION

BB121 recycling (*n.*) A process in which a by-product is converted into an initial reactant and used again in a further batch of reactants, *e.g.* in the extraction of phenols from coal tar, sodium hydroxide is used to react with the phenol:

$$C_6H_5OH + NaOH \rightarrow C_6H_5ONa + H_2O$$

Phenol is a weaker acid than H_2CO_3. CO_2 is blown into the solution of C_6H_5ONa:

$$2C_6H_5.ONa + CO_2 + H_2O \rightarrow 2C_6H_5OH + Na_2CO_3$$

The sodium carbonate is then converted back to sodium hydroxide by the Gossage process. The sodium hydroxide so obtained is **recycled.** —RECYCLE (*v.*) ↑ CRACKING

BB122 extraction[2] (*n.*) A process by which a metal is obtained from its ore, or a non-metal from a suitable substance, or a compound from a mineral containing the compound, is called extraction, *e.g.* ***a*** the manufacture of aluminium from bauxite is an extraction; ***b*** bromine is obtained from Stassfurt carnallite which contains magnesium bromide – it is extracted from the carnallite; ***c*** sodium nitrate is extracted from Chile saltpetre. —EXTRACT (*v.t.*) ↑ CRACKING

BB123 salting out (*n.*) **1** (Of hydrophilic colloids) the coagulation of the colloidal particles by the addition of an electrolyte solution of high concentration, *e.g.* soap can be salted out of a colloidal solution. **2** (Of solutions of non-electrolytes) the decrease of the solubility of the non-electrolyte by the addition of a high concentration of sodium chloride, *e.g.* the solubility of phenylamine (aniline) in water can be very much reduced by adding sodium chloride; the aniline is salted out. ↑ CRACKING

BB124 vulcanization (*n.*) The process of converting weak plastic inelastic raw rubber into a strong elastic non-plastic material. There are a number of processes for doing this, of which heating the rubber with sulphur is the main one. —VULCANIZE (*v.*) ↓ COPOLYMERIZATION · TRANSESTERIFICATION → PROCESS[2] · PLASTIC[3]

BB125 copolymerization (*n.*) A process by which copolymers are formed, *i.e.* the monomers are molecules of two kinds. —COPOLYMER (*n.*) ↑ VULCANIZATION

BB126 transesterification (*n.*) A process of refluxing an ester of one alcohol with another alcohol in the presence of a suitable catalyst. ↑ VULCANIZATION

BB127 dye (*n.*) A substance which can give colour to materials, *e.g.* textiles, paper and plastics. They may be of natural origin but

modern dyes are usually synthetic. Dyes may be classified according to their chemical constitution or according to the manner of their application to the material. ↓ MORDANT · PIGMENT

BB128 mordant (*n.*) A substance used with a group of dyes which cannot dye a material directly. The mordant is applied first to the fabric. The dye then forms a compound with the mordant. This compound is called a lake. With acid dyes, metallic hydroxides (chromium, aluminium, iron, tin) are used as mordants; with basic dyes, the mordant is usually tannic acid. ↑ DYE

BB129 pigment (*n.*) A solid substance which may be of organic or inorganic origin. Pigments do not dissolve in water. They are used for colouring paints, varnishes, etc. ↑ DYE

Classification of Matter

BC001 states of matter (*n.pl.*) There are three states of matter: solid, liquid and gas (vapour). Matter can only exist in one of these states. ↓ SOLID[2] · LIQUID[2] · GAS[2] · CHEMICAL STRUCTURE → INORGANIC NOMENCLATURE · PERIODIC SYSTEM · ORGANIC NOMENCLATURE

BC002 solid[2] (*n.*) A solid is a substance with a definite shape. All the entities (atom, ion, or molecule) in a solid have definite positions about which they can vibrate. They have no other motion. True solids have a crystalline structure. The term 'amorphous solid' is applied to glasses and polymers with no regular structure. —SOLIDIFY (*v.*) ***solidification*** (*n.*) SOLID (*adj.*) ↓ ORE · STATE OF DIVISION · METASTABLE · FUSED[1] · ORGANIC[1] ↑ STATES OF MATTER → LIQUID[2] · GAS[2] · CHEMICAL STRUCTURE

BC003 ore (*n.*) A compound of a metal which occurs naturally and from which the metal can be extracted, *e.g.* haematite is a compound of iron; iron is extracted from it. ↓ MINERAL · CHEMICAL[3] ↑ SOLID[2] → CONCENTRATE[1]

BC004 mineral (*n.*) Any naturally occurring substance which is not animal or plant. It includes ores, petroleum, natural gas, and coal. Many such substances are obtained by mining. —MINERAL (*adj.*) ↑ ORE → MINERAL OIL · MINERAL ACID · INORGANIC

BC005 chemical[3] (*n.*) A general term used for any element or compound. ↑ ORE → SUBSTANCE · FINE CHEMICALS · ELEMENT[2] · COMPOUND[1]

BC006 state of division (*n.*) The extent to which a large piece of solid matter has been divided up into smaller pieces, *e.g.* calcium carbonate may exist as large lumps, chips, granules, or powder. These are different possible states of division in which calcium carbonate may be used. ↓ LUMP · POWDER[2] ↑ SOLID[2]

BC007 lump (*n.*) A large irregular piece of solid of irregular shape, *e.g.* a lump of coal or a lump of wood or rock. —***lumpy*** (*adj.*) ↑ STATE OF DIVISION → GRAIN (Sn) · GRANULE (Sn)

BC008 powder[2] (*n.*) A solid substance in which the particles are very small, so small in fact that they cannot be seen with the naked eye. Powders can often flow like liquids □ *a fine powder; a coarse powder* —POWDER (*v.*) ***powdered, powdery*** (*adj.*) ↑ STATE OF DIVISION

BC009 metastable (*adj.*) A metastable form or state is one which will tend to change to a stable form or state, *e.g.* white phosphorous is a metastable form – it will tend to change to red phosphorus (the stable form). ↓ MASSIVE · AMORPHOUS ↑ STATE OF DIVISION

BC010 massive (*adj.*) Describes the state of being in large pieces, *e.g.* a large crystal of quartz is a massive form of silicon dioxide (SiO_2). ↑ STATE OF DIVISION · METASTABLE

BC011 amorphous (*adj.*) Describes a solid which has no crystalline structure. The two main classes of amorphous solids are glasses and polymers (rubbers). ↑ METASTABLE → CRYSTALLINE (I)

BC012 fused[1] (*adj.*) **1** Used in the same sense as **molten**, *e.g.* lead dioxide with fused sodium hydroxide. There is however the suggestion that two or more substances are together in a mixture in these circumstances. **2** Describes certain solid substances which have been raised to high temperatures and reduced to a molten or viscous condition and then allowed to cool and solidify, *e.g.* fused silica; fused calcium chloride. —FUSE (*v.*) ↓ FINELY DIVIDED · COMBINED · NITROGENOUS · UNCOMBINED · NATIVE · MOLECULAR ↑ SOLID[2]

BC013 finely divided (*adj.*) Ground to a powder containing very small particles. Such small particles may also be obtained by special methods of preparation, *e.g.* ***a*** finely divided iron may be made by heating iron (II) oxalate in a stream of hydrogen; ***b*** finely divided nickel is used as a catalyst in the hydrogenation of oils. ↑ FUSED[1]

BC014 combined (*adj.*) Being part of a compound, *e.g.* the element sodium is always found in nature in the combined state; it is never found as the metal. —***combine*** (*v.*) COMBINATION (*n.*) ↓ UNCOMBINED (I) ↑ FUSED[1] → COMPOUND[1]

BC015 nitrogenous (*adj.*) Containing nitrogen in a chemically combined form, *e.g.* ammonium sulphate is a nitrogenous fertilizer. ↑ FUSED[1]

BC016 uncombined (*adj.*) Not in the combined state, *i.e.* existing as the element itself. ↑ FUSED[1] · COMBINED (I)

BC017 native (*adj.*) Describes an element when it is found in nature as the element, uncombined with other elements. Copper, silver, gold and sulphur are all examples of elements that occur native. ↑ FUSED[1]

BC018 molecular (*adj.*) Concerned with molecules, *e.g.* ***a*** the molecular shape of PCl_5 is trigonal bipyramid; ***b*** C_2H_6 is the molecular formula of ethane; ***c*** when benzene solidifies it forms molecular crystals. —MOLECULE (*n.*) ↑ FUSED[1]

BC019 organic[1] (*adj.*) Describes that branch of chemistry which deals with the carbon compounds, excluding the oxides of carbon, carbonic acid, and the carbonates. ↓ INORGANIC (I) ↑ STATES OF MATTER

BC020 inorganic (*adj.*) Describes that branch of chemistry which makes a study of the elements and their compounds, other than carbon and its compounds. It includes, however, oxides of carbon and metal carbonates. ↑ ORGANIC[1] (I)

BC021 liquid[2] (*n.*) A substance which takes up the shape of the vessel in which it is placed. The liquid state is intermediate between the solid and gaseous states but it is closer in properties to the solid state in many ways. The average distance between atoms, ions or molecules is not very different from that in a solid. The forces between atoms, ions or molecules are also not greatly different from those in a solid. There is also evidence of an orderly structure in a liquid. Like a solid, a liquid is not easily compressible. —LIQUEFY, ***liquidize*** (*v.*) LIQUEFACTION (*n.*) LIQUID, ***liquefiable*** (*adj.*) ↓ LIQUID[3] ↑ STATES OF MATTER · SOLID[2] → GAS[2] · CHEMICAL STRUCTURE

BC022 liquid[3] (*adj.*) Possessing the properties of a liquid, *e.g.* mercury is a liquid metal, *i.e.* at room temperature the substance has the properties of a liquid. —LIQUEFY (*v.*) LIQUID (*n.*) ↓ VOLATILE · MISCIBLE · IMMISCIBLE · BOILING[1] · CAUSTIC · BLAND · MILD · CORROSIVE ↑ LIQUID[2]

BC023 volatile (*adj.*) Describes a substance which readily evaporates and diffuses at ordinary atmospheric temperatures and pressures □ *ether is a highly volatile substance* —***volatility, volatilization*** (*n.*) ***volatilize*** (*v.*) ***volatilizable*** (*adj.*) ↑ LIQUID[3] → EVAPORATE[1,2] · SUBLIME

BC024 miscible (*adj.*) Used of liquids which can be mixed completely together without an interface between the two liquids. The result is indistinguishable visibly from a single liquid. ↓ IMMISCIBLE (I) ↑ LIQUID[3]

BC025 immiscible (*adj.*) Used of liquids which do not mix. The less dense liquid forms a layer above the denser liquid and there is a visible interface. ↑ LIQUID[3] (*adj.*) · MISCIBLE (I)

BC026 boiling[1] (*adj.*) Describes a liquid at its boiling point showing the observable signs of boiling. The liquid is turning into a gas through the formation of bubbles throughout the liquid. —BOIL (*v.*) ↑ LIQUID[3]

BC027 caustic (*adj.*) Describes an agent which readily attacks and destroys the surface of living tissue, especially animal flesh. The term is usually applied to alkalis; it is never applied to acids □ *a caustic alkali has a corrosive action on human flesh* —CAUSTICITY (*n.*) CAUSTICIZE (*v.*) ↓ MILD (An) · CORROSIVE ↑ LIQUID[3]

BC028 bland (*adj.*) Soothing and non-irritating, *e.g.* milk is a bland liquid. Bland is similar in meaning to **soft** but soft implies positive qualities whereas bland implies absence of harsh qualities. ↑ LIQUID[3] (*adj.*)

BC029 mild (*adj.*) Intermediate in properties between strong and weak. It is used in chemistry in such collocations as, ***a*** mild steel (a steel with less carbon, in contrast with hard steel); ***b*** mild alkali (neither strong nor weak). ↑ LIQUID[3]

BC030 corrosive (*adj.*) Describes an agent which readily attacks and destroys the surface of living and non-living materials. A corrosive reaction is not necessarily corrosion. Concentrated mineral acids are corrosive because they attack living protein and carbohydrate. A corrosive poison destroys the lining of the stomach. ↑ LIQUID[3] · CAUSTIC (H)

BC031 gas[2] (*n.*) A substance which occupies in a continuous manner the whole space in which it is placed, however large or small the space may be. A gas is the most diffuse state of matter and its atoms, molecules or ions, have almost unrestricted motion. Both a gas and a vapour exist in the gaseous state. A gas exists above the critical temperature. A vapour exists below the critical temperature. Oxygen and hydrogen are typical gases. —GASEOUS (*adj.*) ↓ VAPOUR · BUBBLE[1] · PERMANENT[2] · GASEOUS → SOLID[2] · LIQUID[2] · CHEMICAL STRUCTURE · STATES OF MATTER

BC032 vapour (*n.*) A substance in the gaseous state which separates into two phases when compressed. Below the critical temperature gases become vapours. —VAPORIZE (*v.*) ***vaporization*** (*n.*) ↓ FLUID[2] ↑ GAS[2]

BC033 fluid[2] (*n.*) A substance which flows. Both liquids and gases fall into this group. —***fluidity*** (*n.*) ***fluid*** (*adj.*) ↑ VAPOUR

BC034 bubble[1] (*n.*) A small volume of gas surrounded by a liquid. The liquid may be in bulk or a thin film, as in a soap bubble. —BUBBLE (*v.*) ↑ GAS[2] → EFFERVESCENCE

BC035 permanent[2] (*adj.*) Describes gases which are not easily liquefied. These are the gases like oxygen, hydrogen and nitrogen which have critical temperatures well below the usual atmospheric temperatures. These may be compared with sulphur dioxide, ammonia and nitrogen dioxide, which are easily liquefied. In particular, permanent gases cannot be liquefied by pressures alone at ordinary temperatures. ↑ GAS[2] · VAPOUR → PERMANENT[1]

BC036 noble (*adj.*) Describes the gases of group VIII: helium, neon, argon, krypton,

xenon and radon. They do not (apart from krypton and xenon) take part in chemical reactions. They are monatomic. Their outer electron shells contain only paired electrons □ *argon is a noble gas* 2 Describes the metals gold, platinum, etc., which do not react with ordinary acids. Gold will react with a mixture of concentrated nitric acid and concentrated hydrochloric acid (*aqua regia*) □ *gold is a noble metal* ↓ INERT[1] ↑ PERMANENT[2]

BC037 inert[1] (*adj.*) Describes the gases, helium, neon, argon, krypton, and xenon, which do not normally form chemical compounds. Krypton and xenon are now known to form a few compounds. ↑ PERMANENT[2]

BC038 gaseous (*adj.*) Describes a substance in the form of a gas or a process involving gases, *e.g.* the contact process for the manufacture of sulphuric acid is based on a gaseous reaction between sulphur dioxide and oxygen. —GAS (*n.*) ↑ GAS[2] · VAPOUR

BC039 chemical structure (*n.*) A regularly arranged collection of or combination of connected and dependent parts, the parts being chemical entities. Atoms form a molecule in which the atoms will be arranged in space. They are combined together, held by forces which act between atoms. Atoms themselves have structure because they consist of a number of entities (fundamental particles) arranged and dependent upon one another. A complex organic compound is a collection of atoms and radicals (sometimes ions) fitted together in a three dimensional pattern each part connected to other parts and dependent upon its place in the whole. Chemical structure may be illustrated by a structural formula. ↓ ELEMENT[4] · METAL · SPECIES[2] · ACIDIC · TRIVIAL → STATES OF MATTER

BC040 element[4] (*n.*) An element is a substance of which all the atoms have the same nuclear charge. ↓ COMPOUND[1] · MIXTURE · CONSTITUENT[2] ↑ CHEMICAL STRUCTURE → ATOMIC STRUCTURE

BC041 compound[1] (*n.*) A substance formed when atoms of different elements join together. ↑ ELEMENT[4] → MOLECULE

BC042 mixture (*n.*) A piece of matter which consists of two or more separate elements or compounds. A mixture is usually contrasted with a pure substance which contains only one element or one compound □ *an intimate mixture is one in which the ingredients are as nearly homogeneously distributed as possible* —MIX (*v.*) ***mixed*** (*adj.*) ↑ ELEMENT[4]

BC043 constituent[2] (*n.*) Part of a compound or a mixture (including true and colloidal solutions, and suspensions). The constituents of a compound can include elements, functional groups, simpler compounds, *e.g.* amino acids in proteins, monomers or ions. —***constitute*** (*v.*) ***constitution*** (*n.*) ↑ ELEMENT[4] → PART · INGREDIENT

BC044 metal (*n.*) Metal/nonmetal is a convenient way to classify the elements. Like so many such classifications it is only an approximate division. There are elements which show certain characteristics of nonmetals and vice-versa. The metals of group I are chemically characteristic metals though they lack some physical characteristics. The most important distinction is that metals form positive ions when they enter into chemical reactions. They also conduct electricity and heat. They are lustrous, malleable, and ductile. These physical properties arise mainly from their structure. Nonmetals which have certain features of metal structure may conduct electricity, *e.g.* graphite. Metals in general form oxides which show basic properties. Their compounds with nonmetals have a salt-like character. With the exception of mercury they are solid. They have low ionization energy and low electronegativity. In general speech the term metal is used for solids which conduct electricity, which have lustre, and are ductile and malleable. This includes alloys such as steels, brass and solder. ↓ NONMETAL · METALLOID · ALLOY ↑ CHEMICAL STRUCTURE → INORGANIC NOMENCLATURE

BC045 nonmetal (*n.*) Nonmetals are by definition those elements which are not metals. They may be solid, liquid, or gas. Their physical properties depend upon their structure, *e.g.* diamond is lustrous, graphite less so. Sulphur α (rhombic) is lustrous. They are not ductile or malleable (usually they are brittle). Apart from graphite they do not conduct electricity. When they enter into chemical reactions they form negative ions (note that hydrogen normally forms positive ions but can form negative ions). Their oxides are usually acidic and soluble in water, though some, such as carbon monoxide (CO) and nitrogen oxide (NO), are insoluble and neutral. They have high ionization energies and high electronegativity. ↑ METAL → INORGANIC NOMENCLATURE

BC046 metalloid (*n.*) An element which has properties intermediate between those of a metallic element and a nonmetallic element. Antimony is a metalloid; it is lustrous but brittle. It forms a molecule Sb_4 in the vapour state and has a density 6·7 g cm^{-3}. The metal has a small but measurable conductivity and forms a chloride ($SbCl_3$) which is a low melting point solid and a chloride ($SbCl_5$) which is a fuming liquid. The oxide Sb_4O_6 is amphoteric. Like nitrogen, phosphorus and arsenic, it forms a gaseous hydride. ↑ METAL

BC047 alloy (*n.*) A mixture of two or more metals or of a metal and one or more nonmetals. The result is very much like a solution, in being homogeneous. The alloy often possesses properties like those of its constituents, *e.g.* solder has the low melting point of lead with the hardness of tin. ↑ METAL

BC048 species[2] (*n.*) Chemical species are entities that take part in chemical reactions. They include atoms, molecules, ions, free

radicals, and activated atoms or molecules. ↓ ATOM · MOLECULE · FREE RADICAL ↑ CHEMICAL STRUCTURE → ION

BC049 atom (*n.*) The smallest particle of an element which can be said to exhibit the properties of the element. It consists of a nucleus and extra-nuclear electrons. The nucleus carries a positive charge. The electron carries a negative charge. The atom itself is electrostatically neutral. —***atomic*** (*adj.*) ↑ ELEMENT[4] · SPECIES[2]

BC050 molecule (*n.*) The smallest group of combined atoms of either an element or compound which can have a free existence. The sulphur molecule in the solid state is S_8; the chlorine molecule is Cl_2; the inert gases are monatomic. Atoms in molecules are bound by covalent bonds. Ionic compounds do not form molecules. —MOLECULAR (*adj.*) ↑ SPECIES[2] → COMPOUND · COVALENT

BC051 free radical (*n.*) An atom or group of atoms with unpaired electrons. Such radicals are especially reactive. Many of these are only recognised as intermediate products in reactions, *e.g.* CH_3. Some free radicals, *e.g.* NO and NO_2, are quite stable. ↑ SPECIES[2] → RADICAL

BC052 acidic (*adj.*) **1** Having properties characteristic of an acid; containing an acid, *e.g.* ***a*** sulphuric acid is an acidic compound; ***b*** an acidic solution of hydrogen chloride. **2** Forming an acid when dissolved in water, *e.g.* carbon dioxide is an acidic oxide. ↓ BASIC[2] · ALKALINE (I) · AMPHOTERIC · ACTIVE · METALLIC

BC053 basic[2] (*adj.*) Describes a substance which has the properties of a base or a substance similar to a base, *e.g.* ***a*** oxides of metals are basic oxides; ***b*** some of the less electropositive metals form basic salts with OH^- ions in their structure, *e.g.* basic zinc carbonate $2ZnCO_3.3Zn(OH)_2$; ***c*** basic slag is a base which is alkaline in nature, in contrast to an acid slag. ↑ ACIDIC

BC054 alkaline (*adj.*) Having properties characteristic of an alkali; containing an alkali, *e.g.* ***a*** sodium hydroxide is alkaline; ***b*** an alkaline solution of ammonia in water □ *a weakly, (*or *strongly), alkaline solution; the solution is alkaline to litmus* —ALKALI, ***alkalinity*** (*n.*) ↑ ACIDIC (I) → ALKALI · ACID · NEUTRAL[1]

BC055 amphoteric (*adj.*) Showing both acidic and basic properties, *e.g.* zinc hydroxide in acid solution (HCl) forms zinc chloride solution. Zinc hydroxide in alkaline solution (NaOH) forms sodium zincate solution. ↑ ACIDIC

BC056 active (*adj.*) Describes that part of a mixture which has the particular properties or function which the mixture as a whole exhibits, *e.g.* the active constituent (or principle) of baking powder is sodium hydrogen carbonate. ↑ ACIDIC

BC057 metallic (*adj.*) **1** Having the properties of a metal. **2** Describes a compound of a metal. The adjective is often used to distinguish the compound from an analogous non-metal compound, *e.g.* magnesium chloride is a metallic chloride. —METAL (*n.*) ↑ ACIDIC

BC058 trivial (*adj.*) Describes names of chemical compounds that are traditional for well known compounds. Acetic acid is a trivial name in contrast to ethanoic acid. ↓ CHEMICAL[2] · PHARMACEUTICAL · TRADITIONAL · SYSTEMATIC ↑ CHEMICAL STRUCTURE

BC059 chemical[2] (*adj.*) Having to do with chemistry; involving chemical principles □ *the chemical nature of a substance* ↑ TRIVIAL

BC060 pharmaceutical (*adj.*) Describes a branch of chemical science which concerns itself with chemical substances used for medical purposes. Pharmaceutical names are the special names given to chemicals, *e.g. Ferri et Ammon. Citras* is iron (III) ammonium citrate. —PHARMACY (*n.*) ↑ TRIVIAL

BC061 traditional (*adj.*) Describes chemical names used in the past, *e.g.* cupric sulphate is the traditional name for what is now called copper (II) sulphate; ethyl alcohol is the traditional name for what is now called ethanol; nitrous acid is the traditional name for what is now called nitric (III) acid. ↑ TRIVIAL

BC062 systematic (*adj.*) Describes a type of naming of compounds based on a special international agreed system, the IUPAC System, *e.g.* CH_3COOH is called ethanoic acid, it being thought of as derived from an alkane with two carbon atoms. The *-oic* shows the presence of one — O.OH group. ↑ TRIVIAL

Chemical Nomenclature

BD001 inorganic nomenclature (*n.*) The system of names used in inorganic chemistry for elements and compounds. The names of compounds may be, ***a*** trivial names, *e.g.* green vitriol; ***b*** traditional names, *e.g.* ferrous sulphate; ***c*** systematic names, *e.g.* iron (II) sulphate; ***d*** classification names, *e.g* salt, ionic compound, sulphate, transition element, etc. ↓ OXIDE · ACID · SALT · HALOGEN · SULPHIDE · AMMINE · INDICATOR · IONIC → STATES OF MATTER · PHYSICAL PROPERTY

BD002 oxide (*n.*) A compound of oxygen and another element (metallic or non-metallic), *e.g.* the compound between magnesium and oxygen is magnesium oxide $Mg^{2+}O^{2-}$. ↓ BASE[3] · HYDROXIDE · ALKALI · BASIC OXIDE · PEROXIDE · AMPHOTERIC OXIDE ↑ INORGANIC NOMENCLATURE

BD003 base[3] (*n.*) A compound which reacts

with acids to form a salt and water only. Bases are usually oxides and hydroxides of metals. —BASIC (*adj.*) BASICITY (*n.*) ↑ OXIDE

BD004 hydroxide (*n.*) A compound of a metal ion with the ion OH^-, *e.g.* Na^+OH^- sodium hydroxide, $Fe^{3+}(OH^-)_3$ iron (III) hydroxide. Soluble hydroxides which contain free OH^- ions in solution show the properties of alkalis. ↑ OXIDE

BD005 alkali (*n.*) A compound soluble in water forming a solution containing OH^- as the only negative ions. An alkali is a soluble base. Alkalis may be strong or weak. Strong alkalis are fully ionized in solution, *e.g.* Na^+OH^-. A weak alkali is only partly ionized in solution, *e.g.* NH_4OH ammonium hydroxide. ↑ OXIDE

BD006 basic oxide (*n.*) An oxide which, with an acid, forms a salt. Oxides of metals are basic oxides, *e.g.* CuO copper oxide. Basic oxides which are soluble in water form alkaline hydroxides. ↑ BASE[3]

BD007 higher oxide (*n.*) An oxide in which the metal or nonmetal has a higher oxidation state than the standard value for the element, *e.g.* the standard oxidation state of chromium is 3, as in Cr_2O_3; chromium also has oxides CrO_3 and CrO_5, which show higher oxidation states; these are said to be higher oxides. ↑ OXIDE

BD008 peroxide (*n.*) Oxides which with cold dilute sulphuric acid form hydrogen peroxide. They contain the ion $(O—O)^{2-}$. ↑ OXIDE

BD009 amphoteric oxide (*n.*) An oxide which can behave either as an acidic oxide or a basic oxide. Such oxides may be soluble in both acids and strong alkalis, *e.g.* zinc oxide (ZnO) is an amphoteric oxide:

$$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$$
$$ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$$

↑ OXIDE

BD010 acid (*n.*) A covalent compound which when dissolved in water (or other ionizing solvent) produces a solution containing hydrogen ions as the only positive ions; a compound which contains hydrogen, all or part of which can be replaced directly or indirectly by a metal forming a salt. Acids may be strong or weak, dilute or concentrated. **Strong** or **weak** refer to the degree of ionization of the acid. Hydrochloric acid is a strong acid – it is fully ionized in solution. Ethanoic (acetic) acid is a weak acid – it is only partially ionized. **Dilute** and **concentrated** are terms which refer to concentrations, which may be expressed as grams per cubic decimetre or molarities (M value). —***acidify*** (*v.*) ACID, ACIDIC (*adj.*) ACIDIFICATION (*n.*) ↓ MINERAL ACID · ACIDIC OXIDE · BASICITY

BD011 mineral acid (*n.*) An acid which has, as the central atom in the molecule, an atom of an element other than carbon. Sulphuric acid, hydrochloric acid, and nitric acid are three important mineral acids. ↑ ACID

BD012 acidic oxide (*n.*) An oxide which dissolves in water to form an acid. Such oxides are oxides of nonmetals. Sulphur dioxide (SO_2) is an acidic oxide:

$$SO_2 + H_2O \rightleftharpoons H_2SO_3 \rightleftharpoons 2H^+ + SO_3^{2-}$$

↑ ACID

BD013 basicity (*n.*) The number of hydrogen ions obtainable from one molecule of an acid. One molecule of H_2SO_4 in water produces two hydrogen ions; it therefore has a basicity of 2. —BASIC (*adj.*) ↑ ACID

BD014 salt (*n.*) A compound obtained when all or part of the replaceable hydrogen atoms in a molecule of an acid are replaced directly or indirectly by a metal. Salts may be normal salts or acid salts. Salts are nearly always solid ionic compounds. ↓ NORMAL SALT · ACID SALT · BASIC SALT · SALT HYDRATE · DOUBLE SALT ↑ INORGANIC NOMENCLATURE

BD015 normal salt (*n.*) A normal salt is one in which all the replaceable hydrogen atoms in a molecule of an acid have been replaced by a metal. The term is only used for acids with basicity greater than one. ↑ SALT

BD016 acid salt (*n.*) An acid salt is formed when only part of the replaceable hydrogen in an acid is replaced by a metal. The anion of an acid salt (in solution) may be acidic or it may be alkaline, *e.g.* ***a*** the hydrogen sulphate ion (HSO_4^-) is acidic; ***b*** the hydrogen carbonate ion (HCO_3^-) is alkaline. ↑ SALT

BD017 basic salt (*n.*) A salt of a weakly electropositive element, such as Cu, which in neutral or weakly alkaline solution often forms an insoluble precipitate. These are a complex of the original salt with the hydroxide or oxide of the metal: $Cu_4(OH)_6SO_4$ is basic copper (II) sulphate; Mg(OH)Cl is basic magnesium chloride. ↑ SALT

BD018 salt hydrate (*n.*) A salt which has water of crystallization. ↑ SALT

BD019 double salt (*n.*) A compound that is a mixture of two simple salts crystallized together. A solution of a double salt is simply a solution of all the ions of the simple salts. Iron (II) ammonium sulphate – $FeSO_4.(NH_4)_2SO_4.6H_2O$ – is an example of a double salt. ↑ SALT

BD020 halogen (*n.*) An element belonging to group VII of the periodic table. The well known members are fluorine, chlorine, bromine and iodine. ↓ HALIDE · ALKALI METALS · ALKALINE EARTH METALS · COINAGE METALS ↑ INORGANIC NOMENCLATURE

BD021 halide (*n.*) Any compound which has a halogen element atom(s) joined to a metal, nonmetal, alkyl radical (group), etc. NaCl is a metal halide. CH_3Cl is an alkyl halide. ↑ HALOGEN

BD022 chloride (*n.*) A compound of an element with the nonmetallic element chlorine. With metals, the chlorides are usu-

ally ionic. With nonmetals they are covalent, *e.g.*:
ionic chloride Na^+Cl^-
covalent chloride $S_2Cl_{2(l)}$
covalent chlorides with chain structure $(BeCl_2)_n$

In organic nomenclature the traditional names are as chlorides. Thus C_2H_5Cl is ethyl chloride. The systematic names are as chloro- compounds. C_2H_5Cl is chloroethane. ↑ HALOGEN

BD023 bromide (*n.*) A compound of an element with the nonmetallic element bromine. With metals the bromides are usually ionic. With nonmetals they are covalent, *e.g.*:
ionic bromide K^+Br^-
covalent bromide PBr_3
chain structures $CuBr_2$
↑ HALOGEN

BD024 iodide (*n.*) A compound of an element with the nonmetallic element iodine. With metals the iodides are usually ionic; with nonmetals they are covalent, *e.g.*:
ionic iodide K^+I^-
covalent iodide PI_3
↑ HALOGEN

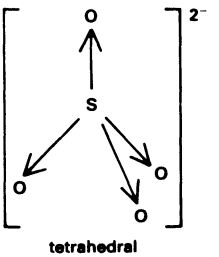
BD025 alkali metals (*n.pl.*) The elements of group I of the periodic table. They all have one *s* electron in their outer shells. They form positive ions of oxidation state I. Their oxides are soluble in water to form alkalis. The alkali metals are lithium (Li), sodium (Na), potassium (K), rubidium (Rb), caesium (Cs) and francium (Fr). ↑ HALOGEN

BD026 alkaline earth metals (*n.pl.*) The elements of group II of the periodic table. Their oxides (originally called earths) form alkalis with water although they (the oxides) are not very soluble in water. They all have two *s* electrons in their outer shells. They form positive ions of oxidation state II. The alkaline earth metals are beryllium (Be), magnesium (Mg), calcium (Ca), strontium (Sr), barium (Ba) and radium (Ra). ↑ HALOGEN

BD027 coinage metals (*n.pl.*) As the name implies they are the traditional metals used for coins. This is not, however, the case now in most parts of the world. They form a group of 3 metals as the seventh group of the transition elements in the periodic table. They form positive ions but show variable oxidation states. The elements are copper (Cu), silver (Ag) and gold (Au). Copper shows oxidation states I and II (Cu^+ and Cu^{2+}). Silver shows oxidation states I and II (Ag^+ and Ag^{2+}, although Ag^+ is the more usual). Gold shows oxidation states I and III (Au^+ and Au^{3+}). ↑ HALOGEN

BD028 sulphide (*n.*) A compou..d of an element with the nonmetallic element sulphur. With metals it forms ionic compounds, *e.g.* $Ca^{2+}S^{2-}$, calcium sulphide, giant structures, *e.g.* FeS, iron II sulphide, and covalent molecules with other nonmetals, *e.g.* CS_2, carbon disulphide. The ionic sulphides can be described as the salts of the weak acid H_2S. ↓ SULPHATE · SULPHITE · THIOSULPHATE · CARBONATE · NITRATE ↑ CHLORIDE · BROMIDE · IODIDE · INORGANIC NOMENCLATURE

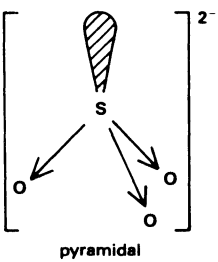
BD029 sulphate (*n.*) A compound of a metal containing the ion SO_4^{2-} (sulphate ion), *e.g.* magnesium sulphate $Mg^{2+}SO_4^{2-}$. The structural formula of the ion is:



SULPHATE ION

Sulphates may be described as salts of sulphuric acid (sulphuric (VI) acid). ↑ SULPHIDE

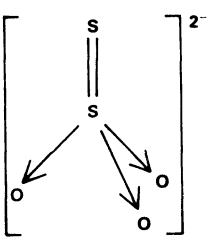
BD030 sulphite (*n.*) A compound of a metal containing the ion SO_3^{2-} (sulphite ion), *e.g.* sodium sulphite $(Na^+)_2SO_3^{2-}$ The structural formula of the ion is:



SULPHITE ION

Sulphites may be described as salts of sulphurous (sulphuric (IV)) acid. ↑ SULPHIDE

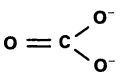
BD031 thiosulphate (*n.*) A compound of a metal containing the ion $S_2O_3^{2-}$. The structural formula of the ion is:



THIOSULPHATE ION

Thiosulphates may be described as the salts of thiosulphuric acid. Compare the structure of the ion with that of SO_4^{2-}. ↑ SULPHIDE

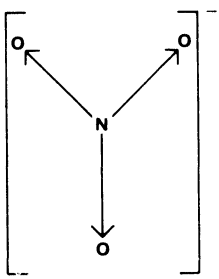
BD032 carbonate (*n.*) A compound of a metal containing the ion CO_3^{2-} (carbonate ion), *e.g.* calcium carbonate $Ca^{2+}CO_3^{2-}$. The structural formula of the ion is:



CARBONATE ION

Carbonates may be described as salts of carbonic acid (a very weak acid which exists only in solution). ↑ SULPHIDE

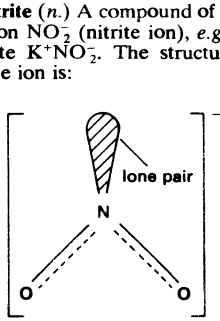
BD033 nitrate (*n.*) A compound of a metal containing the ion NO_3^- (nitrate ion), *e.g.* sodium nitrate $Na^+NO_3^-$. The structural formula of the ion is:



NITRATE ION

Nitrates may be described as salts of nitric acid. Covalent nitrates also exist; *e.g.* glyceryl trinitrate (nitroglycerine explosive) and fluorine nitrate, NO_3F. ↑ SULPHIDE

BD034 nitrite (*n.*) A compound of a metal with the ion NO_2^- (nitrite ion), *e.g.* potassium nitrite $K^+NO_2^-$. The structural formula of the ion is:



NITRITE ION

Nitrites may be described as the salts of nitrous acid HNO_2 which exists in solution at temperatures around 0°C. Covalent nitrites of structure RON=O isomeric with nitro compounds also exist, *e.g.* $C_2H_5ON{=}O$, ethyl nitrite. ↑ SULPHIDE

BD035 ammine (*n.*) A compound containing the group $-NH_3$ joined to a metal atom by a coordinate bond (dative covalent bond), *e.g.* $[Cu(NH_3)_4]^{2+}$, the tetrammine copper (II) ion. ↑ INORGANIC NOMENCLATURE

BD036 indicator (*n.*) A substance which has different colours in different environments. These environments in elementary studies are usually acidic and alkaline solutions. Universal indicator gives a series of colours for a specific range of hydrogen ion concentrations (pH value), *e.g.* pH 2 red, pH 4 pink, pH 6 orange, pH 7 greenish yellow, pH 8 green, etc. Common acid/alkali indicators are litmus, methyl orange and phenolphthalein. ↑ INORGANIC NOMENCLATURE

BD037 ionic (*adj.*) Describes a bond, compound, reaction or equation, etc., in which ions are involved, *e.g.* ***a*** K^+Cl^- is an ionic compound; ***b*** the bond between the sodium and chlorine in sodium chloride is an ionic bond; ***c*** the reaction between calcium choride solution and sodium carbonate solution is an ionic reaction between the calcium ion and the carbonate ion; ***d*** the reaction between magnesium and an acid is represented by the ionic equation:

$$Mg_{(s)} + 2H^+_{(aq)} \rightarrow Mg^{2+}_{(aq)} + H_{2(g)}$$

□ *the ionic character of a bond* —IONIZE (*v.*) ION (*n.*) ↓ COVALENT (Ag) ↑ INORGANIC NOMENCLATURE

BD038 covalent (*adj.*) Describes a bond, compound, reaction, etc., which does not involve ions, *e.g.* ***a*** the bond between carbon and hydrogen in methane (CH_4) is a covalent bond; ***b*** sulphur dioxide (SO_2) is a covalent compound; ***c*** the reaction between ammonia (NH_3) and HCl dissolved in toluene is a covalent reaction. —COVALENCY (*n.*) ↑ IONIC (Ag)

BD039 periodic system (*n.*) A system of classification based originally on Mendeléeff's periodic law which suggested a periodicity of properties based upon atomic weights (relative atomic mass). There were a number of difficulties in the classification which were removed by basing classification on atomic number. Since atomic number is equal to the number of extra-nuclear electrons the classification is really based on the extra-nuclear electron structure. The system provides for groups (vertical arrangements) and periods (horizontal arrangements) thus building up the periodic table. ↓ PERIODIC TABLE · GROUP[1] · PERIOD[2] → STATES OF MATTER

BD040 periodic table (*n.*)

1	2										3	4	5	6	7	8
1 H															1 H	2 He
3 Li	4 Be										5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	**transition series**									13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 * 71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 † 103															

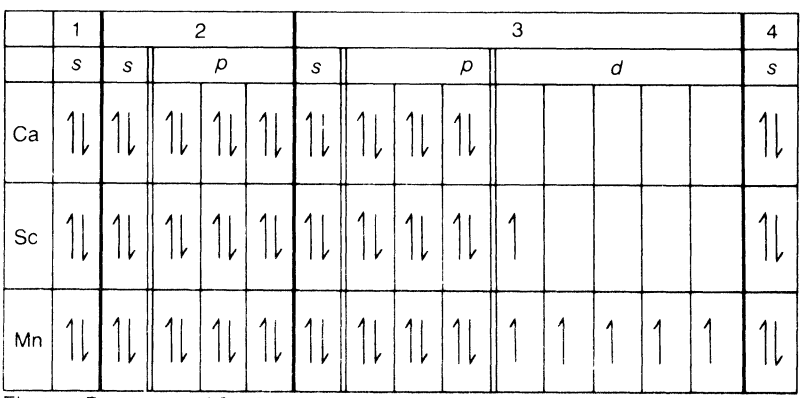
lanthanides and actinides (inner transition series)

*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
†	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lw

↓ PERIODICITY · TRANSITION SERIES · LANTHANIDES · ACTINIDES ↑ PERIODIC SYSTEM

BD041 periodicity (*n.*) (In a chemical context) a regular occurrence of similar properties of elements with increasing atomic numbers. The elements of atomic number 3, 11 and 19 are all alkali metals with the physical and chemical properties of those elements. Periodicity is caused by the distribution of electrons in energy levels (orbitals). —PERIOD (*n.*) PERIODIC (*adj.*) ↑ PERIODIC TABLE

BD042 transition series (*n.*) There are three normal transition series corresponding to three periods of elements: from atomic number 21 to 30; from 39 to 48; and from 72 to 80. Each series contains 10 elements, and there are three elements in each group down the table. The first transition series is in the fourth period of the periodic table (note that periods 1, 2, and 3 have no transition elements). The first transition series,



Electron Distribution of Ca, Sc and Mn

from 21 to 30, contains the elements scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, and zinc. Note that there is a fourth transition series – only two members, with atomic numbers 104 and 105, have so far been discovered (see **periodic table** opposite).

Transition series occur because of the possibility of electrons filling orbitals. The energy level of the 4*s* orbital is lower than those of the 3*d* orbital. When the 4*s* orbital has been filled, in forming potassium and calcium, the next electron (for scandium) goes into the 3*d* orbital. The first transition series is a series in which the 3*d* orbitals are being filled. The electron distribution for calcium, scandium, and manganese is shown opposite. Transition elements are characterized by variable valency, complex ion formation, and the ability to form coloured compounds.

In addition to the normal transition series there are two **inner transition series** – from atomic number 57 to 71 and from 89 to 103. In these, *f* orbitals are being filled. The two series are called the lanthanide series and the actinide series respectively. ↑ PERIODIC TABLE

BD043 lanthanides (*n.pl.*) The set of 14 elements which follow lanthanum in period 6 of the periodic table. They represent the filling of the 5*f* orbital by electrons. This set was formerly called the rare-earth group of elements. They are sometimes referred to as the inner transition series. ↑ PERIODIC TABLE

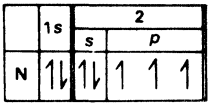
BD044 actinides (*n.pl.*) The set of fourteen elements which follow actinium in period 7 of the periodic table. They represent the filling of the 6*f* orbitals. They form a second period in the inner transition series. ↑ PERIODIC TABLE

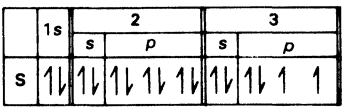
BD045 group[1] (*n.*) A vertical arrangement of elements in the periodic classification in columns. The elements Li, Na, K, Rb, Cs and Fr are in group I of the periodic table. ↓ S-BLOCK ELEMENTS · P-BLOCK ELEMENTS · D-BLOCK ELEMENTS · F-BLOCK ELEMENTS ↑ PERIODIC SYSTEM

BD046 *s*-block elements (*n.pl.*) That section of the periodic table whose elements have completed electron shells with their outer electron orbitals containing one or two *s* electrons. This section includes the elements of group I and group II of the periodic table. ↑ GROUP[1] → ATOMIC STRUCTURE

BD047 *p*-block elements (*n.pl.*) The elements of groups III to VIII inclusive in the period table. They are called *p*-block elements because the outermost electrons occupy *p*-orbitals. Their properties are thereby characterized by the number and arrangement of *p* electrons. ↑ GROUP[1] → ATOMIC STRUCTURE

BD048 *d*-block elements (*n.pl.*) The elements of the transition series whose outmost electron shell contains s electrons but





p-BLOCK ELEMENTS

the penultimate shell contains from one to ten *d* electrons. The properties of this block of elements are characterized by the number and arrangement of their *d* electrons. ↑ GROUP[1] → ATOMIC STRUCTURE

BD049 *f*-block elements (*n.pl.*) Elements belonging to the lanthanides and actinides. Their structure depends on the filling of *f*-orbitals. ↑ GROUP[1] → ATOMIC STRUCTURE

BD050 period[2] (*n.*) The periods of the periodic table of the elements are sets of elements in horizontal arrangements. The elements of period 2 are lithium, beryllium, boron, carbon, nitrogen, oxygen, fluorine and neon. There is a gradual change of character in the elements as one passes from left to right – from chemically characteristic metal to characteristic nonmetal. ↑ PERIODIC TABLE · GROUP[1]

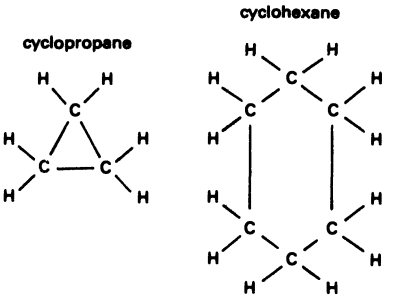
BD051 organic nomenclature (*n.*) The names used in organic chemistry. These may be: ***a*** trivial names, *e.g.* cane sugar, urea; ***b*** traditional names, *e.g.* acetic acid, ethylene; ***c*** systematic names, *e.g.* ethanoic acid, ethene; ***d*** classification names, *e.g.* alkane, amide, aliphatic compound, cyclic compound. ↓ ALIPHATIC COMPOUND · GENERAL FORMULA · CHAIN · HOMOLOGOUS[2] · ADDITION[1] · HOMOLOGOUS SERIES → STATES OF MATTER

BD052 aliphatic compound (*n.*) An organic compound that does not contain benzene rings in its molecules. Most aliphatic compounds have open chains of atoms – either straight chains or branched chains. Some are alicyclic. The name comes from the fact that the first compounds studied were obtained from fats and fatty acids. ↓ AROMATIC COMPOUND · ALICYCLIC COMPOUND · HETEROCYCLIC COMPOUND · SINGLE BOND · DOUBLE BOND · TRIPLE BOND · BENZENE RING ↑ ORGANIC NOMENCLATURE

BD053 aromatic compound (*n.*) An organic compound that contains a ring of carbon atoms with alternating double and single bonds. The simplest example is benzene; other aromatic compounds are naphthalene and anthracene. ↑ ALIPHATIC COMPOUND

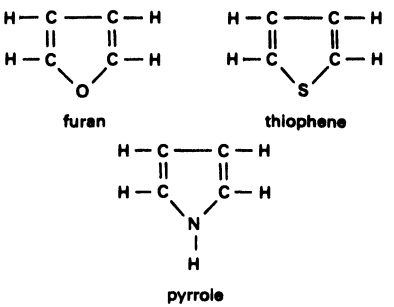
BD054 alicyclic compound (*n.*) A compound that has a closed ring of carbon atoms, but does not have alternating double and single bonds. Alicyclic compounds are

aliphatic and cyclic. Common examples are cyclopropane and cyclohexane:



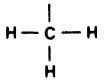
↑ ALIPHATIC COMPOUND

BD055 heterocyclic compound (*n.*) An organic compound with molecules that have a ring of atoms containing other atoms than carbon:



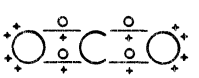
↑ ALIPHATIC COMPOUND

BD056 single bond (*n.*) A covalent bond between two atoms formed by two atoms sharing a pair of electrons. In methane (CH_4) there are 4 single bonds:

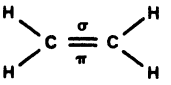


The term would be incorrectly used of an ionic bond. ↑ ALIPHATIC COMPOUND → COVALENT BOND

BD057 double bond (*n.*) A covalent bond formed by two shared pairs of electrons as in:

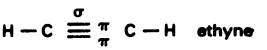


An important type of double bond is formed between two carbon atoms. The bonds are not equivalent. One is a σ bond and the other a π bond. Such an arrangement requires the carbon atom to be in its sp^2 state. In ethene the double bond is this type:



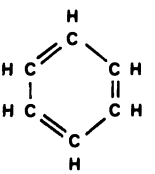
↑ ALIPHATIC COMPOUND → UNSATURATED

BD058 triple bond (*n.*) A covalent bond formed by three shared pairs of electrons. A triple bond exists in nitrogen molecules, N≡N. In the triple bond between two carbon atoms, the three bonds are one σ and two π bonds, as



↑ ALIPHATIC COMPOUND → UNSATURATED

BD059 benzene ring (*n.*) The formula worked out by Kekulé for benzene contains three double bonds. A hexagon of six carbon atoms with alternate double and single bonds is a benzene ring:



In fact the bonds in the benzene ring are all of equal length. It is usual to think of the six carbon atoms joined by six bonds, and the bonds combining together to give a single delocalized bond of 6 electrons. This is represented in formulae by a hexagon with a circle inside it.

↑ ALIPHATIC COMPOUND → CHEMICAL BOND

BD060 general formula (*n.*) A general formula of a series is one which allows the writing of the formula of any member of the series. The general formula of the alkanes is C_nH_{2n+2}, where n can be any number from 1 upwards. If n is 1 the first member's formula is CH_4, methane. If n is 16 the compound will be $C_{16}H_{34}$, hexadecane. The general formula of the primary amines is $C_nH_{2n+1}NH_2$ ↓ HOMOLOGUE[3] · FUNCTIONAL GROUP · RADICAL ↑ ORGANIC NOMENCLATURE

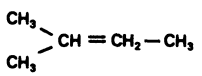
BD061 homologue[3] (*n.*) A member of a homologous series when compared with another member or other members. —HOMOLOGOUS (*adj.*) ↑ GENERAL FORMULA

BD062 functional group (*n.*) An atom or group of atoms which governs the behaviour of the molecules of members of a homologous series, *e.g.* —OH is the functional group of the alcohols. The characteristic properties of the alcohols are due to the —OH group. ↑ GENERAL FORMULA

BD063 radical (*n.*) A group of atoms which is often found unchanged in a group of compounds and also persists unchanged through a chemical reaction or series of reactions. Many of them are in fact ions, the atoms of which are covalently bonded together, *e.g.* sulphate radical (ion), ammonium radical (ion). The term can apply also to organic groups, especially such groups as CH_3·, C_6H_5·, CH_3CO·, etc. ↑ GENERAL FORMULA

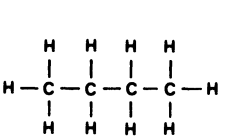
BD064 chain (*n.*) A number of atoms joined together in a line. A chain may be straight or unbranched as in: $CH_3—CH_2—CH_2—CH_3$.

Alternately it may be branched:



↓ STRAIGHT CHAIN · BRANCHED CHAIN · RING (I) ↑ ORGANIC NOMENCLATURE

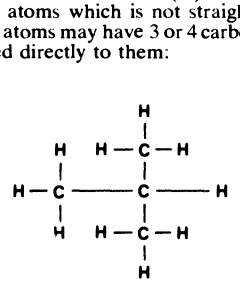
BD065 straight chain (*n.*) A chain of carbon atoms in which any one carbon atom is not attached to more than two other carbon atoms, *e.g.* in butane:



butane

—***straight chain*** (*adj.*) ↓ BRANCHED CHAIN (I) ↑ CHAIN

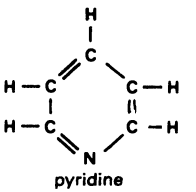
BD066 branched chain (*n.*) A chain of carbon atoms which is not straight. Some carbon atoms may have 3 or 4 carbon atoms attached directly to them:



methyl propane

—BRANCHED CHAIN (*adj.*) ↑ CHAIN (H) · STRAIGHT CHAIN (I)

BD067 ring (*n.*) A chain of carbon atoms may be joined together to form a ring structure. The best known of these is the benzene ring with 6 carbon atoms.



pyridine

↑ CHAIN (I)

BD068 aromaticity (*n.*) The property of having aromatic character, referring to the properties associated with benzene and other aromatic compounds. Aromaticity may include, ***a*** unexpected chemical properties, *e.g.* unusual behaviour of the double bond; ***b*** a molecule of large resonance energy. ↑ CHAIN

BD069 homologous[2] (*adj.*) Corresponding in structure, relationship or value; used especially in chemistry of series of organic compounds which have a single general formula and the same functional group, differing in molecular formula by $—CH_2—$. The alcohols are a homologous series with the general formula $C_nH_{2n+1}OH$, functional group —OH. Methanol, CH_3OH, and ethanol, C_2H_5OH, two members of the series, differ by $—CH_2—$ in molecular formula. —HOMOLOGUE (*n.*) ↑ ORGANIC NOMENCLATURE

BD070 addition[1] (*adj.*) Applied to a compound it means formed by an addition process. Applied to a reaction it means resulting in an addition compound, *e.g.* ***a*** 1, 2-dibromoethane is an addition compound; ***b*** the reaction of ethene with bromine is an addition reaction; ***c*** the reaction between ethanal (acetaldehyde) and sodium bisulphite is an addition reaction producing ethanal bisulphite compound, an addition compound.

$$CH_3CHO + NaHSO_3 \rightarrow CH_3CHOH.SO_3Na$$

—ADDITION (*n.*) ↓ CYCLIC ↑ ORGANIC NOMENCLATURE

BD071 cyclic (*n.*) Describes a chemical compound in which the molecule is made up of one or more rings of atoms, *e.g.* benzene is a cyclic compound. A cyclic process is one which passes through a number of stages ending up with a product which can be removed and other reactants which can be used again for another round (or cycle) of the process. —CYCLE (*n.*) ***cycle, recycle*** (*v.*) ↑ ADDITION[1]

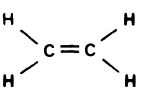
BD072 homologous series (*n.*) A series of organic compounds in which the compounds have relative molecular masses which differ by 14 from the preceding member in the series Members of the series can be represented by a general formula and have similar structures, show a regular gradation of physical properties (*e.g.* m.p., b.p., solubility), have similar chemical properties and can be prepared by similar

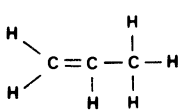
methods. The alkanes form an homologous series with general formula C_nH_{2n+2}; the relative molecular masses of the first four members are 16, 30, 44 and 58. Boiling points increase with increase in the number of carbon atoms, etc. Other series are:
alkenes C_nH_{2n}
alcohols $C_nH_{2n+1}OH$
alkynes C_nH_{2n-2}
fatty acids $C_nH_{2n+1}COOH$
amines $C_nH_{2n+1}NH_2$
↓ HYDROCARBON · ALCOHOL · ALKYL HALIDE · NITRILE · ESTER · ALKYL · SATURATED[2] → CARBOHYDRATE[1] · SUGAR · HEXOSE[1] · FAT[1]

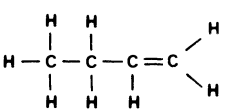
BD073 hydrocarbon (*n.*) A compound containing only carbon atoms and hydrogen atoms. Hydrocarbons are covalent compounds. They include alkanes, alkenes, alkynes, and benzene hydrocarbons.
↓ ALKANE (H) · ALKENE (H) · ALKYNE (H)
↑ HOMOLOGOUS SERIES

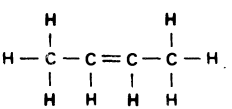
BD074 alkane (*n.*) A straight-chain or branched-chain hydrocarbon containing only single bonds and of general formula C_nH_{2n+2}. The first four members are named methane, ethane, propane and butane. Thereafter they are named *-ane* preceded by the Greek number prefix which indicates the number of carbon atoms, *e.g.* heptane C_7H_{16}, heptacontane $C_{70}H_{142}$.
↑ HYDROCARBON

BD075 alkene (*n.*) A straight-chain or branched-chain hydrocarbon with one double bond. Alkenes have the general formula C_nH_{2n}. When more than one form is possible, as in butene, the systematic naming is:


ethene


propene


but-1-ene


but-2-ene

↑ HYDROCARBON

BD076 alkyne (*n.*) A straight-chain or branched-chain hydrocarbon that contains one triple bond. Alkynes have the general formula C_nH_{2n-2}, *e.g.*

acetylene (ethyne) $H-C\equiv C-H$

methyl acetylene (propyne) $CH_3-C\equiv C-H$

but-1-yne $CH_3-CH_2-C\equiv C-H$

but-2-yne $CH_3C\equiv CCH_3$

↑ HYDROCARBON · ALKANE (Sn)

BD077 paraffin (*n.*) Traditional name for an alkane; originally used because of their comparative unreactivity (small affinity).
↑ HYDROCARBON · ALKANE (Sn)

BD078 olefine *or* **olefin** (*n.*) Traditional name for an alkene. ↑ HYDROCARBON · ALKENE (Sn)

BD079 alcohol (*n.*) An organic compound which contains one or more hydroxyl groups (—OH). The alcohols are hydroxy derivatives of alkanes. They form the homologous series $C_nH_{2n+1}OH$. They can be classified by the nature of the carbon atom to which they are attached:

primary: $R-CH_2OH$
secondary: $R_2CH(OH)$
tertiary: $R_3C(OH)$

They can also be classified according to the number of hydroxyl groups:

monohydric C_2H_5OH ethanol
dihydric CH_2OH-CH_2OH 1, 2-dihydroxy ethane; ethane-1, 2-diol (ethylene glycol)
trihydric $CH_2OH-CHOH-CH_2OH$ propane-1, 2, 3-triol (glycerol)

↓ ALDEHYDE · KETONE · CARBOXYLIC ACID · ETHER ↑ HOMOLOGOUS SERIES

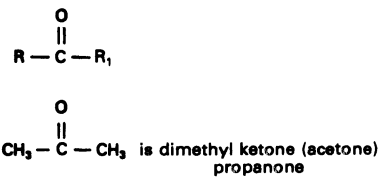
BD080 aldehyde (*n.*) A compound that is the first oxidation product of a primary alcohol. The functional group is:

$$-C(=O)-H$$

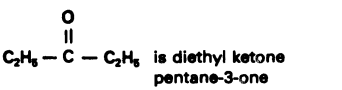
A systematic naming uses *-al* after the corresponding alkane:
CH_3CHO ethanal
(traditional: acetaldehyde) named after the acid to which it is converted on oxidation.
↑ ALCOHOL

BD081 ketone (*n.*) The first oxidation

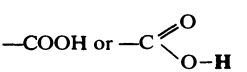
product of secondary alcohols. The functional group is —CO.
Ketones have the general structure:



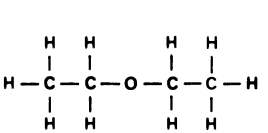
where R and R_1 may be hydrocarbon radicals, aliphatic or aromatic. The ketones of a simple structure may be named by R and R_1 of their structure, or a systematic name may indicate the position of the —CO group:



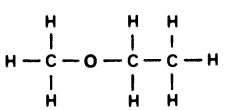
↑ ALCOHOL
BD082 carboxylic acid (*n.*) An acid which contains the group



in its structure. The **H** is the replaceable hydrogen atom. ↑ ALCOHOL
BD083 ether (*n.*) These are compounds of general structure R—O—R_1. The best known is:



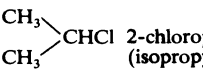
Diethyl ether is commonly called ether. R and R_1 can represent aliphatic or aromatic radicals. If R and R_1 are different groups the ethers are called *mixed* or *unsymmetrical* ethers, *e.g.*



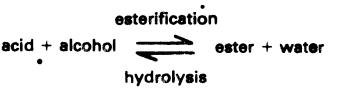
↑ ALCOHOL
BD084 alkyl halide (*n.*) A compound formed by substituting a halogen atom into an alkane. The traditional method of naming is by analogy with inorganic halides, *e.g.*

CH_3Cl chloromethane (methyl chloride)

$CH_3.CH_2.CH_2Cl$ 1-chloropropane (propyl chloride)



↑ ALCOHOL
BD085 haloform (*n.*) A compound of the structure CHX_3 in which X may be chlorine, bromine or iodine. The commonest example is chloroform ($CHCl_3$, trichloromethane). ↑ ALKYL HALIDE
BD086 nitrile (*n.*) A compound containing the group —C≡N. The compound C_2H_5—C≡N is called propanonitrile (propano because there are 3 carbon atoms). ↓ AMINE · AMIDE · AMINO ACID[1] · ALKYL CYANIDE ↑ HOMOLOGOUS SERIES
BD087 amine (*n.*) A compound containing the amino (—NH_2) functional group. ↑ NITRILE
BD088 amide (*n.*) A compound which contains the group —CO.NH_2 *e.g.* ethanamide. ↑ NITRILE
BD089 amino acid[1] (*n.*) A carboxylic acid in which one hydrogen of the hydrocarbon radical has been replaced by —NH_2 (amino). Amino acids are important because they form the essential units of proteins. The simplest is glycine, NH_2CH_2COOH, which is also called aminoacetic acid (traditional) and aminoethanoic acid (systematic). ↑ NITRILE
BD090 alkyl cyanide (*n.*) The traditional name used for a nitrile, *e.g.* C_2H_5—C≡N, propanonitrile, used to be called (and still is by many) ethyl cyanide. ↑ NITRILE · ALKYL HALIDE
BD091 ester (*n.*) A compound formed when all or part of the replaceable hydrogen of an acid is replaced by an alkyl or aryl group. The acid may be inorganic or organic although the most important esters are formed with organic carboxylic acids. The ester may also be seen as a compound between an acid and an alcohol. Most such reactions are reversible:



—***esterify*** (*v.*) ***esterification*** (*n.*) ↓ FAT[1] · OIL[1] ↑ HOMOLOGOUS SERIES
BD092 fat[1] (*n.*) Fats are esters of glycerol with various organic acids. In the fats the organic acids are saturated acids. They are

almost always straight chain. The important acids are:

$C_{11}H_{23}COOH$ dodecanoic acid (lauric acid)

$C_{13}H_{27}COOH$ tetradecanoic (myristic acid)

$C_{15}H_{31}COOH$ hexadecanoic acid (palmitic acid)

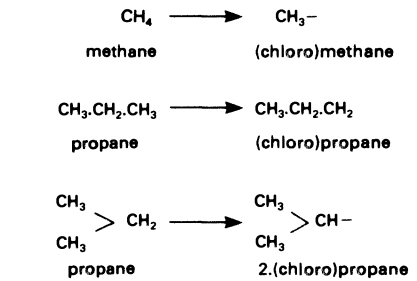
$C_{17}H_{35}COOH$ octadecanoic acid (stearic acid)

$CH_2O.OC.C_{17}H_{35}$
|
$CH.O.OC.C_{17}H_{35}$ tristearin
|
$CH_2O.OC.C_{17}H_{35}$

Fats can exist which have different acid groups attached to the glycerol. Fats are usually solid at ordinary temperatures. ↑ ESTER

BD093 oil[1] (*n.*) Oils are esters of glycerol with unsaturated acids, of which the most usually occurring are oleic acid, linoleic acid, and linolenic acid. The systematic names are too difficult for this book. Oleic acid has one double bond, linoleic has two double bonds, and linolenic has three double bonds. ↑ FAT

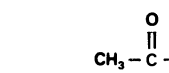
BD094 alkyl (*adj.*) A group with the general formula C_nH_{2n+1}—. An alkyl group results from a corresponding alkane (C_nH_{2n+2}) by removal of a hydrogen atom



↓ ARYL · ACYL ↑ HOMOLOGOUS SERIES

BD095 aryl (*adj.*) A group formed by removal of a hydrogen atom from an aromatic hydrocarbon. Removal of a hydrogen atom from benzene gives the phenyl group, C_6H_5—. ↑ ALKYL

BD096 acyl (*adj.*) A group formed by removal of —OH from a carboxylic acid. Removal of —OH from ethanoic (acetic) acid gives the ethanoyl (acetyl) group, CH_3CO.



↑ ALKYL

BD097 saturated[2] (*adj.*) Having all the valence electrons of the carbon atoms paired (all the valencies of carbon satisfied). It implies the absence of double or triple bonds between carbon atoms. Alkanes and their derivatives are saturated compounds □ *a saturated fat is one formed from a saturated acid,* i.e. *one in which the carbon chain has only* —C—C— *bonds.* ↓ UNSATURATED (I) ↑ HOMOLOGUE

BD098 unsaturated (*adj.*) Describes an organic compound which contains one or more double bonds (or triple bonds) between carbon atoms. These double bonds will be one σ-bond and one π-bond. The triple bond will be one σ-bond and two π-bonds. The reactivity of the alkenes is due to the unsaturated nature of these compounds. ↑ SATURATED[2] (I)

BD099 carbohydrate[1] (*n.*) Substances of the general formula $C_x(H_2O)_y$. This is why they are called carbohydrates. Carbohydrates are either sugars or polysaccharides. (Note this excludes methanal (formaldehyde) CH_2O and ethanoic acid, $C_2H_4O_2$.) → HOMOLOGOUS SERIES

BD100 sugars (*n.pl.*) A group of crystalline compounds which have a sweet taste and are soluble in water. The sugars are carbohydrates. Glucose and sucrose are common examples. ↓ POLYSACCHARIDE[1] · DISACCHARIDE[1] · MONOSACCHARIDE[1] → HOMOLOGOUS SERIES

BD101 polysaccharide[1] (*n.*) One of a group of carbohydrates that are more complex than sugars, usually non-crystalline and not sweet. They are usually not soluble in water. On hydrolysis they produce a number of monosaccharide molecules. Starch $(C_6H_{10}O_5)_n$ and cellulose are common examples. ↑ SUGARS

BD102 disaccharide[1] (*n.*) A sugar which yields two monosaccharide sugars on hydrolysis. Disaccharides have the formula $C_{12}H_{22}O_{11}$. Sucrose and maltose are common examples. ↑ SUGARS

BD103 monosaccharide[1] (*n.*) A sugar which cannot be hydrolysed into smaller molecules. Monosaccharides have the general formula $C_nH_{2n}O_n$, where n is 3-10. Most monosaccharides are pentoses (5) and hexoses (6), *e.g.* glucose $C_6H_{12}O_6$. ↑ SUGARS

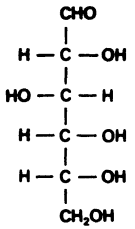
BD104 hexose[1] (*n.*) One of a group of monosaccharides of formula $C_6H_{12}O_6$. They fall into two classes, aldohexoses and ketohexoses. Glucose is an example of a hexose which is an aldose, *i.e.* an aldohexose. Fructose is an example of a hexose which is a ketose, *i.e.* a ketohexose. ↓ PENTOSE[1] · REDUCING SUGAR · ALDOSE · KETOSE → ORGANIC NOMENCLATURE

BD105 pentose[1] (*n.*) One of a group of monosaccharides with formula $C_5H_{10}O_5$. They fall into two classes, aldopentoses and ketopentoses. Ribose is an aldopentose; it is an aldose and a pentose. All the ketopentoses are synthetic except L-xylulose. ↑ HEXOSE[1]

BD106 reducing sugar (*n.*) A sugar which has the property of reducing Fehlings or

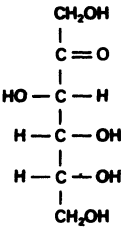
Benedict's solution to copper (I) oxide. Glucose is a reducing sugar. ↑ HEXOSE[1] → REDUCING AGENT · REDUCTION

BD107 aldose (*n.*) If a monosaccharide has a molecule which contains the —CHO group, it is called an aldose. **Glucose** is an example of an aldose:



↑ HEXOSE[1]

BD108 ketose (*n.*) A monosaccharide which contains a carbonyl group (> C = O). **Fructose** is an example of a ketose:



↑ HEXOSE[1]

General Macrostructure

BE001 macrostructure (*n.*) The external and observable features of structures, *e.g.* the triclinic crystal form of $CuSO_4.5H_2O$ is a feature of its macrostructure. ↓ POLYMORPHISM[1] · FORMULA[1] · ISOMERISM → CRYSTAL STRUCTURE

BE002 polymorphism[1] (*n.*) The disposition of substances to exist in more than one crystalline form. The term applies to both elements and compounds in the solid state, *e.g.* ***a*** red mercury (II) iodide changes to a yellow form at 120°C; ***b*** calcium carbonate may be found in two crystalline forms as calcite and aragonite. Polymorphism may be of two kinds, enantiotropy and monotropy. Allotropy is a special form of polymorphism. —POLYMORPHIC (*adj.*) POLYMORPH (*n.*) ↓ ALLOTROPY · ENANTIOTROPY · MONOTROPY ↑ MACROSTRUCTURE

BE003 allotropy (*n.*) This is the disposition of an element to exist in two or more forms without change of state. If the forms are crystalline forms they may also be called polymorphic, *e.g.* ***a*** the element sulphur exists in two solid forms – rhombic sulphur (S_α) and monoclinic sulphur (S_β); ***b*** the element carbon exists in two crystalline forms, diamond and graphite; ***c*** the element oxygen exists in two gaseous forms, O_2 and O_3; ***d*** liquid sulphur contains three allotropes, $S\lambda$, $S\mu$ and $S\eta$; it is probable that $S\lambda \equiv S_8$ and $S\eta \equiv S_4$; the molecular state of $S\mu$ is not known □ *diamond and graphite are allotropes of carbon, i.e. they are allotropic forms of carbon; carbon exhibits allotropy* —***allotrope*** (*n.*) ALLOTROPIC (*adj.*) ↑ POLYMORPHISM[1]

BE004 enantiotropy (*n.*) A type of polymorphism in which the change between forms is reversible – one form being stable above the transition point and the other stable below it. Sulphur exhibits enantiotrophy – $S\alpha$ is the stable form below 95.5°C; $S\beta$ is the stable form above 95.5°C. The transition temperature is below the melting point of either form. —ENANTIOTROPIC (*adj.*) ↑ POLYMORPHISM[1]

BE005 monotropy (*n.*) A type of polymorphism in which the change is not reversible and one form is always the unstable form which will change to the stable form. This change may be extremely slow and may take place at any temperature. There is no transition temperature, *e.g.* both carbon and phosphorus exhibit monotropy. In the case of carbon, diamond is the unstable form. In the case of phosphorus, the white phosphorus is the unstable form. The unstable form has the higher energy content. —MONOTROPIC (*adj.*) ↑ POLYMORPHISM[1]

BE006 dynamic allotropy (*n.*) A form of allotropy in which dynamic equilibrium exists between the different allotropes. ↑ POLYMORPHISM[1]

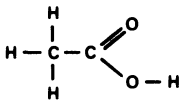
BE007 formula[1] (*n.,pl.* **formulae** *or* **formulas**) A collection of chemical symbols and numbers which gives information about the composition and structure of an element or compound, *e.g.* the formula for copper (II) sulphate crystals is $CuSO_4.5H_2O$; the formula for rhombic sulphur is S_8; the formula for sodium chloride is Na^+Cl^- (or NaCl). ↓ EMPIRICAL FORMULA · MOLECULAR FORMULA · STRUCTURAL FORMULA ↑ MACROSTRUCTURE

BE008 empirical formula (*n.*) The simplest formula which can be written for a compound using its composition by weight. It

gives the elements contained in the compound and their simplest ratio. ↑ FORMULA[1]

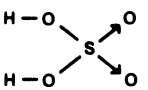
BE009 molecular formula (*n.*) A formula which gives the elements and the number of atoms of each present in a molecule of a covalent compound, *e.g.* $C_6H_{12}O_6$ is the molecular formula of glucose; CH_2O is the empirical formula. ↑ FORMULA[1]

BE010 structural formula (*n.*) A formula which shows how the elements are grouped and how the bonds are distributed in a molecule. The structural formula for ethanoic (acetic) acid is CH_3COOH or:



ethanoic acid

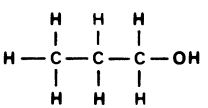
For sulphuric acid the molecular formula is:



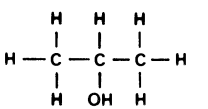
sulphuric acid

↑ FORMULA[1]

BE011 isomerism (*n.*) The property of having the same molecular formula but different structural formulae, *e.g.* there are two alcohols with molecular formula C_3H_7OH:



propan-1-ol
$CH_3.CH_2.CH_2OH$



propan-2-ol
$CH_3.CH(OH)CH_3$

—ISOMER (*n.*) ISOMERIC (*adj.*) ↓ ISOMER ↑ MACROSTRUCTURE

BE012 isomer (*n.*) One of two or more compounds which have the same molecular formula but different structural formulae, *e.g.* propan 2-ol is an isomer of propan-1-ol. —ISOMERISM (*n.*) ISOMERIC (*adj.*) ↓ ALLOTROPE

BE013 ionization isomer (*n.*) Ionization isomers are forms of compounds which have the same molecular formula but exist in isomers, usually of different colours, which ionize in different ways, $CrCl_3.6H_2O$ exists in three forms, one violet, one pale green, one dark green; they have the ionic formulae:

$[Cr(H_2O)_6]^{3+}\ 3Cl^-$
violet
$[Cr(H_2O)_5Cl]^{2+}\ 2Cl^-H_2O$
pale green
$[Cr(H_2O)_4Cl_2]^+\ Cl^-.2H_2O$
dark green

Chromium sulphate also forms ionization isomers. ↑ ISOMERISM

BE014 allotrope (*n.*) One of the forms of an element which shows allotropy, *e.g.* rhombic sulphur (S_α) is an allotrope of sulphur. ↑ ISOMERISM

BE015 revert (*v.i.*) To go back to a previous state, *e.g.* rhombic sulphur is the stable form at ordinary temperatures (below 95°C). Monoclinic sulphur (the stable form above 95°C) when cooled suddenly, remains as monoclinic but slowly reverts to the rhombic form. → MACROSTRUCTURE

BE016 polymorphic[1] (*adj.*) Describes a crystalline form of an element or compound, or the element or compound itself, which exhibits polymorphism, *e.g.* ***a*** red mercury (II) iodide is a polymorphic form of mercury (II) iodide, *i.e.* it is a polymorph; ***b*** the element sulphur is polymorphic. —POLYMORPHISM, POLYMORPH (*n.*) ↓ ALLOTROPIC · ENANTIOTROPIC · MONOTROPIC · ISOMERIC → MACROSTRUCTURE

BE017 allotropic (*adj.*) Describes a form of an element in a given state which exhibits allotropy, *e.g.* ***a*** diamond is an allotropic form or modification of carbon, *i.e.* it is an allotrope of carbon; ***b*** ozone (O_3) is an allotrope of oxygen—it is an allotropic form of oxygen. —ALLOTROPY (*n.*) ***allotrope*** (*n.*) ↑ POLYMORPHIC[1]

BE018 enantiotropic (*adj.*) Describes those forms of elements or compounds, or the elements or compounds themselves, which exhibit enantiotropy, *e.g.* ***a*** S_α and S_β are enantiotropic forms of sulphur; ***b*** sulphur is an enantiotropic element. —ENANTIOTROPY (*n.*) ↑ POLYMORPHIC[1]

BE019 monotropic (*adj.*) Describes the form of an element or compound, or the element or compound themselves, which exhibits monotropy, *e.g.* ***a*** red and white phosphorus are monotropic forms of phosphorus; ***b*** phosphorus is a monotropic element. ↑ POLYMORPHIC[1]

BE020 isomeric (*adj.*) Describes the forms of a compound which show isomerism, *e.g.* dimethyl ether (CH_3OCH_3) and ethanol (C_2H_5OH) are isomeric. ↑ POLYMORPHIC[1]

Surface Phenomena

BF001 surface phenomena (*n.pl.*) Phenomena that depend on the properties of the surface of a solid or liquid. The properties of a substance are often quite different at its surface from those inside the substance. This is because an atom or molecule inside the substance has forces all around it; at the surface the forces are unbalanced, they act only towards the inside of the substance, on one side of the atom or molecule. Because of this, surfaces have special properties; they are different from the properties of the substance as a whole (the ***bulk*** properties). Thus, melting or elasticity are *not* surface phenomena because they depend on the whole material. Friction, surface tension, and the photoelectric effect *are* surface properties, because they depend on processes that take place at the surface of the material. These are physical properties. Surface phenomena may also be chemical effects, *e.g.* tarnishing and other forms of corrosion, adsorption, and catalysis. ↓ ADSORPTION[1] · SURFACE-ACTING AGENT · PHASE[2] · TARNISH[1,2] · PASSIVE → MACROSTRUCTURE

BF002 adsorption[1] (*n.*) The formation of a thin layer of a substance attached to the surface of a solid or liquid, *e.g.* a clean metal surface in contact with a gas is quickly covered by a thin layer of the gas; molecules of the gas are held on the surface by physical or chemical forces. Often the layer is only one molecule thick (unimolecular layer); in some cases it may be two or more molecules thick (multimolecular layer). Contrast adsorption and **absorption**: in adsorption the substance is held on the surface, in absorption it penetrates into the interior of the material. —***adsorb*** (*v.*) ↑ SURFACE PHEMOMENA ↓ PHYSICAL ADSORPTION · CHEMISORPTION · SORBENT

BF003 physical adsorption (*n.*) An adsorption process that is rapid, reversible, and not chemically specific. There is a relation between the ease of adsorption and the readiness of the gas (vapour) to condense to a liquid. The forces which hold the gas molecules on the surface are van der Waals forces, *e.g.* water vapour is adsorbed into the surface of wood charcoal. In physical adsorption the amount of gas adsorbed usually decreases as the temperature rises. ↓ CHEMISORPTION (I) ↑ ADSORPTION[1]

BF004 physisorption (*n.*) Alternative term for PHYSICAL ADSORPTION (↑).

BF005 chemisorption (*n.*) An adsorption process that involves the formation of a surface compound. The adsorbed molecules are held on the surface by chemical bonds, *e.g.* hydrogen adsorbs on nickel surfaces by forming atoms which make bonds to the nickel atoms on the surface. The rate of chemisorption is often very fast, but in some cases it is slow and increases as the temperature rises. —***chemisorb*** (*v.*) ↑ ADSORPTION[1] · PHYSICAL ADSORPTION (I)

BF006 sorbent (*n.*) Any material that is used to absorb or adsorb another substance. ↑ ADSORPTION[1] → CHROMATOGRAPHY · THIN-LAYER CHROMATOGRAPHY

BF007 surface-acting agent (*n.*) A compound which lowers the surface tension of water when the compound is dissolved in water. The molecules of the compound concentrate in the surface layers in preference to water molecules. Detergents and soaps are common examples of surface-acting agents. → SURFACE TENSION

BF008 soap[2] (*n.*) Any metallic salt of a fatty acid. The term is usually applied to the water soluble soaps of which the most important are the sodium and potassium soaps. Only the water-soluble soaps have detergent properties. Hard soaps are usually sodium salts and soft soaps are potassium salts. The most usual acids involved are stearic (octadecanoic) acid $C_{17}H_{35}COOH$, and palmitic (hexadecanoic) acid $C_{15}H_{31}COOH$. ↑ SURFACE-ACTING AGENT

BF009 detergent (*n.*) Any substance used for cleansing. Detergents include soaps, but the term is often used for synthetic detergents (made from sulphonic acids). All detergents are surface-acting agents. Their molecules consist of long hydrocarbon chains (which are insoluble in water) attached to acidic groups (which are soluble in water). ↑ SURFACE-ACTING AGENT

BF010 ion exchange (*n.*) A process represented by the equation:

$$R\text{——}H^+ + Na^+ \rightleftharpoons R\text{——}Na^+ + H^+$$

If Na^+ is present in excess, *i.e.* if $R - H^+$ is washed with a solution containing Na^+, then exchange takes place. R may be a cross-linked polymer with a group of the type $-(SO_2O)^-H^+$ (an ion exchange resin). This process is cation exchange. Similarly the end group may be a negative ion as in $-[N(CH_3)_3]^+OH^-$, in which case anion exchange occurs. —***ion exchanger*** (*n.*) → SURFACE TENSION

BF011 phase[2] (*n.*) Any part of a system which is homogeneous and divided from any other homogeneous portion of the system by a boundary, *e.g.* ***a*** in a closed vessel, ice, water, and water vapour at 1.5 mm Hg pressure and 0.0075°C are three phases – a solid phase, a liquid phase, and a gaseous phase; ***b*** phenol and water at room temperature do not mix; a mixture of the two forms two liquid phases. ↓ INTERFACE ↑ SURFACE PHENOMENA

BF012 interface (*n.*) The boundary between phases in a heterogeneous system, *e.g.* ***a*** in a vessel containing water and water vapour, the surface of the liquid is the interface between the two phases (the liquid phase and gaseous phase); ***b*** a gas bubble in water, *e.g.* oxygen bubbling through water, can be seen as a small sphere as though surrounded by a skin, the interface between gas

and liquid. —***interfacial*** (*adj.*) ↑ PHASE[2] → BOUNDARY · HETEROGENOUS

BF013 tarnish[1] (*n.*) A thin film of oxide or sulphide formed on the surface of a lustrous metal causing the surface to become dull or to change colour. Silver and copper form tarnish in air but pure gold and platinum do not —TARNISH (*v.*) ***tarnished*** (*adj.*) ↓ CORROSION (Sn) ↑ SURFACE PHENOMENA

BF014 rust[1] (*n.*) An hydrated oxide of iron, $Fe_2O_3.xH_2O$, formed as a reddish-brown incrustation on the surface of iron in moist air. —***rusting*** (*n.*) RUST (*v.*) ***rusty*** (*adj.*) ↑ TARNISH[1]

BF015 corrosion (*n.*) The process by which the surface of a metal is destroyed by chemical action, leaving the surface pitted. —CORRODE (*v.*) CORROSIVE (*adj.*) ↑ TARNISH[1]

BF016 tarnish[2] (*v.t.,i.*) **1** (*v.i.*) To form a dull layer on the surface by reaction with oxygen or sulphur compound, *e.g.* silver tarnishes in air by forming a layer of silver sulphide. **2** (*v.t.*) To cause a dull layer to form on (a metal), *e.g.* sulphur tarnishes silver. —TARNISH (*n.*) ↓ CORRODE[1] · RUST[2] ↑ SURFACE PHENOMENA

BF017 corrode[1] (*v.t.,i.*) **1** (*v.i.*) To undergo corrosion, *e.g.* ***a*** iron corrodes in air forming rust; ***b*** lead corrodes in soft water; ***c*** copper corrodes in the atmosphere forming a green coating on the surface. **2** (*v.t.*) To bring about corrosion of (a solid), *e.g.* the atmospheric gases corrode iron. —***corrosion*** (*n.*) CORROSIVE (*adj.*) ↓ RUST[2] (H) ↑ TARNISH[2] (H)

BF018 rust[2] (*v.t.,i.*) **1** (*v.i.*) To become coated with rust, *e.g.* iron rusts in moist air. **2** (*v.t.*) To cause iron to become coated with rust, *e.g.* moist air rusts iron. —RUST (*n.*) ↑ TARNISH[2]

BF019 passive (*adj.*) Unreactive because of the formation of a thin layer of oxide which stops further chemical reaction. Aluminium becomes passive in air by formation of a thin transparent layer of aluminium oxide. Pure iron becomes passive in concentrated nitric acid. □ *to render iron passive* —***passivity*** (*n.*) ↑ SURFACE PHENOMENA

Crystal Structure

BG001 crystal structure (*n.*) A crystal has both internal and external structure. The internal structure is the arrangement of ions, atoms, or molecules in a regularly repeated pattern. The external structure is the geometric shape of a crystal, determined from the arrangement of crystal faces and symmetry of the crystal. External structure depends upon internal structure. Structures may be named from, ***a*** the internal pattern, *e.g.* cubic close packing; ***b*** a common compound with that structure, *e.g.* sodium chloride structure. ↓ LATTICE · CRYSTAL · CRYSTAL CHEMISTRY · CRYSTALLIZE · CRYSTALLINE · ANHYDROUS → MACROSTRUCTURE

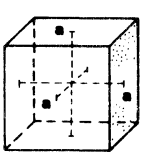
BG002 lattice (*n.*) A regular geometrical arrangement of points in space. ↓ CRYSTAL LATTICE · CRYSTAL SYSTEMS · CRYSTAL SYMMETRY · CRYSTAL FACE · CLEAVAGE PLANE · SLIP PLANE · WATER OF CRYSTALLIZATION ↑ CRYSTAL STRUCTURE

BG003 crystal lattice (*n.*) A lattice of points in space representing the positions of the atoms, ions, or molecules forming the crystal. The crystal can be ionic, metallic, giant molecular, or molecular. A lattice extends continuously in three dimensions as far as the boundary of the crystal. A lattice is a geometric pattern of ions, atoms, or molecules in a crystal. ↑ LATTICE → LATTICE ENERGY

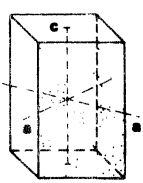
BG004 crystal systems (*n.pl.*) Crystals are grouped into seven major systems: cubic, tetragonal, orthorhombic, monoclinic, rhombohedral or trigonal, hexagonal and triclinic. The groups are made on the basis of symmetry. ↑ LATTICE

BG005 crystal symmetry (*n.*) Symmetry of the external shape and internal structure of a crystal. A crystal can have a plane or planes of symmetry, an axis or axes of symmetry, or a centre of symmetry. ↑ LATTICE → SYMMETRY

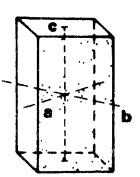
BG006 crystal face (*n.*) A plane surface of a crystal. The simplest crystal shape is a cube. It has six plane faces and each face is at right angles to an intersecting face. The faces of a crystal intersect (meet) at an angle. ↑ LATTICE



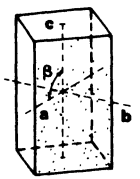
cubic



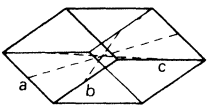
tetragonal



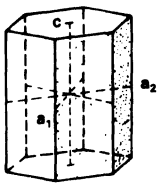
orthorhombic

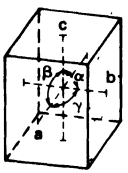


monoclinic



rhombohedral or trigonal





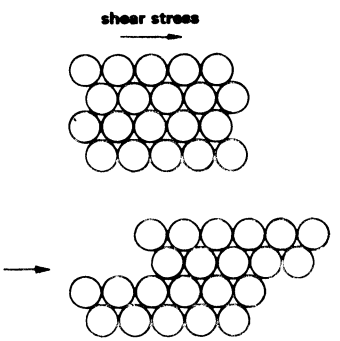
triclinic

system	axes	angles
cubic	a = b = c	α = β = γ = 90°
tetragonal	a = b ≠ c	α = β = γ = 90°
orthorhombic	a ≠ b ≠ c	α = β = γ = 90°
monoclinic	a ≠ b ≠ c	α = γ = 90°; β ≠ 90°
rhombohedral or trigonal	a = b = c	α = β = γ ≠ 90°
hexagonal	a = b ≠ c	α = β = 90°; γ = 120°
triclinic	a ≠ b ≠ c	α ≠ β ≠ γ ≠ 90°

CRYSTAL SYSTEMS

BG007 cleavage plane (*n.*) A plane inside a crystal along which a crystal can be split (cleaved). The cleavage plane is formed in the internal structure by particles in planes in the crystal lattice. A blow not in the cleavage plane shatters (as opposed to cleaves) a crystal into tiny pieces. ↑ LATTICE

BG008 slip plane (*n.*) A plane inside a crystal along which one part of the crystal can move relative to another when a stress is applied. Part of the crystal lattice on one side of the plane **slips** over the part on the other side. Slip takes place in the direction of close packing of the planes; it is the process responsible for the ductility of metals. ↑ LATTICE → DUCTILE[1]



SLIP PLANE

BG009 water of crystallization (*n.*) A fixed amount of water associated with crystals (built into the crystal structure) when the crystals are obtained from solution in water; removal of this water alters the structure of the crystal, *e.g.* copper (II) sulphate forms blue crystals, $CuSO_4.5H_2O$; when its water of crystallization is removed it becomes a white powder, $CuSO_4$; in the blue crystals four of the H_2O molecules are joined to the copper ion by coordinate bonds:

$$\left[\begin{array}{c} H_2O \\ \downarrow \\ H_2O \rightarrow Cu \leftarrow H_2O \\ \uparrow \\ H_2O \end{array}\right]^{2+}$$

The fifth water molecule is held in position by hydrogen bonds. ↑ LATTICE

BG010 crystal (*n.*) A regularly shaped piece of a substance with naturally formed plane faces. The angles between corresponding faces of a crystal are the same in all crystals of the same substance. —CRYSTALLIZATION (*n.*) CRYSTALLIZE (*v.*) CRYSTALLINE (*adj.*) CRYSTALLOID (*n.*) CRYSTALLOID (*adj.*) ↓ CRYSTALLIZATION · CRYSTAL NUCLEUS · CRYSTAL GRAIN · X-RAY DIFFRACTION ↑ CRYSTAL STRUCTURE

BG011 giant structure (*n.*) Ionic, metal, and giant molecular (macromolecular) crystals have a giant structure. Such crystals have no discrete molecules; the bonds between the atoms or ions extend throughout the whole crystal, so that it is like a single, very large molecule. ↑ CRYSTAL

BG012 giant molecular crystal (*n.*) A type of crystal composed of atoms held together by covalent bonds. The covalent bonds join all the atoms together throughout the whole crystal. This makes the crystal very strong and hard. Diamond has a giant molecular crystal composed of carbon atoms. ↑ CRYSTAL

BG013 metal crystal (*n.*) A type of crystal formed by metallic elements. The crystal is composed of a lattice of positively charged metal ions held together by a cloud of electrons, which can move through the lattice. This accounts for the ability of metals to conduct heat and electricity. ↑ CRYSTAL

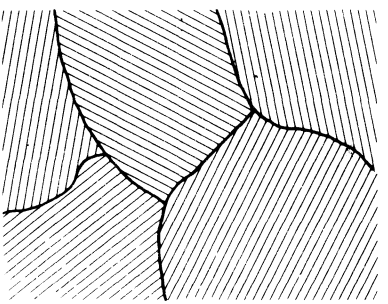
BG014 molecular crystal[2] (*n.*) A type of

crystal composed of individual molecules. The molecules themselves have covalent bonds, as in carbon dioxide, O=C=O. In the crystal the molecules are held together by weak physical forces (van der Waals forces). The crystal is thus formed of an arrangement of molecules. Molecular crystals are soft and have low melting points as a result of the weak van der Waals forces. ↑ CRYSTAL

BG015 crystallization (*n.*) The process of making, forming, or producing crystals. —CRYSTALLIZE (*v.*) ↑ CRYSTAL

BG016 crystal nucleus (*n., pl.* **crystal nuclei**) A small particle or point on which a crystal can start to grow. A nucleus for growth is one of the following, ***a*** a face of an existing crystal; ***b*** a foreign body, *e.g.* a dust particle in a solution; ***c*** a point on the surface of the vessel containing a solution or a molten substance. ↑ CRYSTAL

BG017 crystal grain (*n.*) In many crystalline materials the substance does not form a single crystal in which the atoms have a regular arrangement throughout the whole solid. Instead, a piece of substance is made up of many small regions (crystal grains) all joined together. The grains meet at grain boundaries. ↑ CRYSTAL

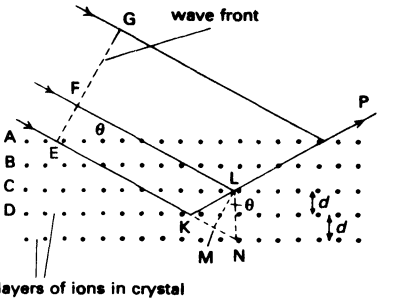


CRYSTAL GRAIN

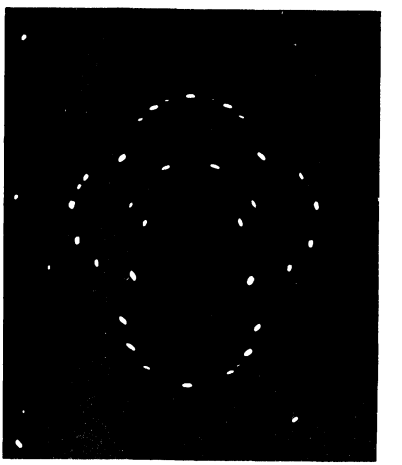
BG018 X-ray diffraction (*n.*) X-ray waves have a much shorter wavelength than visible light waves. X-rays will not therefore be diffracted by a diffraction grating of the ordinary kind. Ionic crystals contain ions arranged in planes closer together than the wavelength of X-rays. X-rays will therefore produce diffraction patterns when passed through a crystal. If the wavelength of the X-rays is known then X-ray diffraction provides useful means of investigating crystal structure. ↑ CRYSTAL

BG019 crystal chemistry (*n.*) The study of the relations between the structure of crystals and their chemical properties. ↑ CRYSTAL STRUCTURE

BG020 crystalloid[1] (*n.*) Any substance that passes through a permeable membrane and forms crystals from a solution of the substance. Any substance that forms a true solution rather than a colloidal solution. —CRYSTALLOID (*adj.*) ↑ CRYSTAL STRUCTURE → COLLOID (I)



diffraction of X-rays by a calcite crystal



X-RAY DIFFRACTION

BG021 crystallize (*v.t.,i.*) **1** (*v.i.*) To form into crystals, *e.g.* copper sulphate crystallizes from water. **2** (*v.t.*) To cause to form crystals, *e.g.* to crystallize sugar from solution □ *alums crystallize in the form of octahedra; to crystallize out of a solution* —CRYSTAL (*n.*) CRYSTALLINE, ***crystallizable, crystallizing*** (*adj.*) ↓ SEED[1] ↑ CRYSTAL STRUCTURE

BG022 seed[1] (*v.t.*) To add a small crystal of a pure compound to a solution of the compound in order to start crystallization. The seed crystal acts as a crystal nucleus. —SEED (*n.*) ↑ CRYSTALLIZE

BG023 crystalline (*adj.*) Crystalline materials have a regular crystal lattice. They do not necessarily form single regular crystals, *e.g.* all metals are crystalline because the atoms have a regular arrangement. ↓ CRYSTALLOID[2] ↑ CRYSTAL STRUCTURE → AMORPHOUS (An)

BG024 crystalloid[2] (*adj.*) Having the properties of a crystalloid. —CRYSTALLOID (*n.*) ↑ CRYSTALLOID[1] · CRYSTALLINE

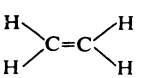
BG025 anhydrous (*adj.*) Having no water of crystallization. Ionic compounds which contain water of crystallization in their structure can lose this water and become anhydrous, *e.g.* sodium sulphate decahydrate (sodium sulphate 10 water) $Na_2SO_4.10H_2O_1$, loses water to form anhydrous sodium sulphate, Na_2SO_4. ↑ CRYSTAL STRUCTURE ↓ HYDRATED[1]

BG026 hydrated[1] (*adj.*) Being associated with water molecules; the term is applied to, ***a*** ions, as in hydrated copper ion, also called copper aqua ion; ***b*** crystals, *e.g.* hydrated sodium carbonate. ↑ ANHYDROUS (I)

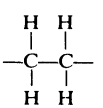
Polymers and Glasses

BH001 polymers and **glasses** Amorphous solids in which there is no long range order. Polymers are described below. The glasses consist of a framework of silica (SiO_4 tetrahedra in cross-linked layers) with cations bonded into the structure. Common glass is made by fusing sand, limestone and sodium carbonate. This is a glass with a low softening point. If the limestone is replaced by oxides of aluminium and boron, a borosilicate glass is formed which is hard and has a high softening point. If lead oxide is added a glass of high refractive index is formed. ↓ POLYMERIZATION · POLYMERIZE · PLASTIC[3] · PLASTIC[2]

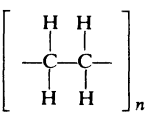
BH002 polymerization (*n.*) A process that leads to the formation of macromolecules (large molecules) made up of repeated structural units (**mers**). These mers are provided by the reacting monomers but are not structurally identical with them, *e.g.* ethene (ethylene) is a monomer:



On polymerization the mers are:



The polymer is:



—POLYMERIZE (*v.*) ↓ POLYMERIZE · PLASTIC[3]

BH003 mass polymerization (*n.*) A process in which a bulk monomer is converted to a polymer. ↑ POLYMERIZATION

BH004 solution polymerization (*n.*) A process in which a monomer is converted into a polymer in solution. ↑ POLYMERIZATION

BH005 suspension polymerization (*n.*) A process in which the monomer containing the initiator is polymerized while dispersed in an inert liquid. ↑ POLYMERIZATION

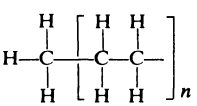
BH006 emulsion polymerization (*n.*) A process in which an aqueous solution of the monomer and a water-soluble initiator are mixed. On polymerization a colloidal dispersion of polymer is formed in the water. ↑ POLYMERIZATION

BH007 initiator (*n.*) A substance which is added to a monomer to start the chain reaction in some forms of polymerization, *e.g.* benzoyl peroxide is the initiator in the polymerization of vinyl compounds. ↑ POLYMERIZATION

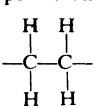
BH008 dimer (*n.*) A molecule (or compound) formed by the joining of two molecules of the same substance, *e.g.* ethanoic (acetic) acid exists as a dimer in solution in benzene as a result of hydrogen bonds between the molecules. —***dimeric*** (*adj.*) ***dimerize*** (*v.*) ↑ POLYMERIZATION

BH009 monomer (*n.*) The original compound from which a polymer is formed, *e.g.* ethylene (ethene) is the monomer from which polyethylene is formed. Sometimes the polymerization goes only to one or two molecules, *e.g.* the monomer CH_3COOH, ethanoic (acetic) acid, forms the dimer $(CH_3COOH)_2$ in suitable circumstances. When the addition polymer contains only two mers the process is usually called association or dimerization. —***monomeric*** (*adj.*) ↑ POLYMERIZATION

BH010 mer (*n.*) A structural unit which is repeated a very large number of times in a polymer, *e.g.* in the polymer:



the mer is the repeated unit:



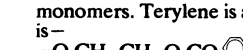
↑ POLYMERIZATION

BH011 natural polymer (*n.*) A polymer which occurs naturally, *e.g.* proteins, starch, cellulose, and dextran. ↑ POLYMERIZATION

BH012 addition polymer (*n.*) A polymer formed when two or more simple molecules (monomers) join together to form a new

compound having the same empirical formula but a much higher relative molecular mass. They are characterized by the extremely rapid rate of their formation. ↑ POLYMERIZATION

BH013 condensation polymer (*n.*) A polymer formed by chemical condensation, *i.e.* by removal of small molecules such as H_2O, HCl, NH_3. The structural units (mers) have no structural identity with the monomers. Terylene is an example; the mer is—



the monomers are—

↑ POLYMERIZATION

BH014 copolymer (*n.*) A copolymer is formed by using two or more different monomers, *e.g.* vinyl chloride–vinyl acetate copolymer. —***copolymerization*** (*n.*) ***copolymerize*** (*v.*) ↑ POLYMERIZATION

BH015 link[2] (*n.*) A bond or short chain of atoms joining other chains together. **Cross-linking** is the formation of links between chains of a polymer. The process converts a thermoplastic material to a thermosetting form, *e.g.* in the vulcanization of rubber, sulphur cross-links the polymer chains. ↑ POLYMERIZATION

BH016 polymerize (*v.t.,i.*) **1** (*v.i.*) To form into a polymer, *e.g.* ethene (ethylene) polymerizes to polyethylene (polythene). **2** (*v.t.*) To cause to form into a polymer, *e.g.* to polymerize ethene. —POLYMERIZATION (*n.*) ↓ CONDENSE[2] ↑ POLYMERIZATION

BH017 condense[2] (*v.t.,i.*) **1** (*v.i.*) (Of molecules) to join together to form a larger molecule and a small molecule such as H_2O, HCl, or NH_3. **2** (*v.t.*) To cause molecules to join together in this way. —***condensation*** (*n.*) ↑ POLYMERIZE

BH018 plastic[3] (*n.*) A member of a class of artificial materials, usually made from organic chemicals. They are polymers in structure. They possess the disposition of being easily deformed and moulded at suitable temperatures. (Metal and rubber are excluded from this classification). ↓ THERMOPLASTIC · THERMOSETTING PLASTIC · PLASTICITY[2] · PLASTICIZER

BH019 thermoplastic (*n.*) A type of plastic that can be softened by heating, moulded into shape, and hardened by chilling. Thermoplastics can again be softened by heating and the process can be repeated, *e.g.* polythene, polyvinyl chloride, and perspex, are thermoplastics. These materials consist of linear polymers; they are soluble in organic solvents. ↑ PLASTIC[3]

BH020 thermosetting plastic (*n.*) A type of plastic that can be heat-treated only once. The plastic then hardens (by cross-linking) and cannot be softened by further heat, *e.g.* phenol-methanal resin. Thermosetting plastics are insoluble in organic solvents. ↑ PLASTIC[3]

BH021 plasticity[2] (*n.*) The property (disposition) of being able to undergo deformation under a stress without returning to the original shape when the stress is removed. ↑ PLASTIC[3] → ELASTICITY (I)

BH022 plasticizer (*n.*) A chemical additive which gives a plastic the correct consistency to allow its use for special purposes and under special conditions. —***plasticize*** (*v.*) ↑ PLASTIC[3]

BH023 plastic[2] (*adj.*) Describes a material which changes its shape under a stress but does not return to its original shape when the stress is removed. —PLASTICITY (*adj.*) ↑ POLYMERIZATION → ELASTIC[2] (I)

General Taxonomy

CA001 taxonomy (*n.*) The study of the categorization and classification of living and extinct organisms. **Classical taxonomy** is based on morphological and anatomical differences and resemblances. **Cytotaxonomy** is based on the characters of somatic chromosomes. **Experimental taxonomy** is based on the identification of evolutionary units, as determined experimentally. —***taxon*** (*n.*) ***taxonomic*** (*adj.*) ↓ TAXON · SPECIES[1] · TRIBE · CLASSIFICATION[2] · COENOSPECIES · GROUP[3] · MONOPHYLETIC · PHENETIC · SPECIFIC[3] · PROTISTA · BACTERIUM → PLANT KINGDOM · ANIMAL KINGDOM · CATEGORY · CLASSIFY

CA002 taxon (*n.*) Any unit of classification used for living organisms, *e.g.* bacteria is a taxon. A formal taxon is one in current use in classification, *e.g.* algae is no longer used as a formal taxon as this group of organisms has been split into distinctive named divisions. However algae is still used as a general taxon. ↓ GROUP[2] ↑ TAXONOMY

CA003 group[4] (*n.*) **1** A number of individuals or objects near together, *e.g.* a group of trees. **2** A number of individuals or objects which possess similar properties or characteristics, *e.g.* ***a*** the group of bacteria that take part in the fixation of atmospheric nitrogen; ***b*** the group of alkali metals. —GROUP (*v.*) ***grouped*** (*adj.*) ↑ TAXON → CLUMP · CLUSTER · BUNCH · COLLECTION · CATEGORY

CA004 species[1] (*n.,pl.* **species**) A species is a group of organisms which can reproduce sexually and produce fertile offspring. They cannot breed with other species to produce fertile offspring, although they can breed with members of the same genus to produce sterile offspring (*e.g.* a horse and a donkey

can breed a mule). The characteristics of a species are controlled by the gene pool of the members, resulting in great similarities in genetic composition and few differences in characteristics. When a species is widespread, local differences may arise through mutations, and sub-species can be formed. If reproductive isolation occurs because of geographical factors then the differences can increase and new species can be formed. Unless cross-fertilization occurs freely in sexual reproduction, the concept of a species as a breeding unit no longer holds, and the description of a species must be determined on the basis of structural differences alone. A complete definition of species is thus difficult when applied to all organisms. —SPECIFIC (*adj.*) ↓ VARIETY · GENUS · FAMILY · ORDER[2] · CLASS[2] · PHYLUM · KINGDOM · DIVISION ↑ TAXONOMY → GENE POOL

CA005 variety (*n.*) A sub-group found within a species; the members of the sub-group differ distinctly from other varieties of the same species. The characteristics of a variety are passed on to the offspring. The term is used for all plants and many animals. For domestic animals the term **breed** is used instead of variety. For man, the different races are varieties of the human species. Individuals from different varieties of a species can produce offspring of a mixed variety. ↑ SPECIES[1]

CA006 genus (*n.,pl.* **genera**) Usually a group of closely related species although a genus may consist of one species only. Members of the same genus may be able to interbreed; if they do, the offspring are always sterile in animals, but not always so in plants. All members of a genus bear the same generic name and this is the first name in the binomial nomenclature, *e.g. Equus caballus* is a horse; *Equus asinus* is a donkey. Both animals belong to the same genus *Equus*; they can breed to form a mule, a sterile animal □ *zebras and horses belong to the same genus* —***generic*** (*adj.*) ↓ BINOMIAL NOMENCLATURE ↑ SPECIES[1]

CA007 family (*n.*) A category in the classification of organisms; it consists of a number of closely related genera. Several families form an order. In zoological nomenclature, the names of families end in **-idae** (*e.g.* Bovidae). In botanical nomenclature, the names of families end in **-aceae** (*e.g.* Rosaceae) or in **-ae** (*e.g.* Leguminosae). ↑ SPECIES[1]

CA008 order[2] (*n.*) A category in classification consisting of one or several families. Similar orders are grouped into a **class**. In zoological nomenclature, the names of orders end in **-a**. In botanical nomenclature, the names of orders end in **-ales**. —***ordinal*** (*adj.*) ↑ SPECIES[1]

CA009 class[2] (*n.*) A category used in classification. One or several closely related classes are grouped in a phylum, or a subphylum, *e.g.* vertebrates. ↑ SPECIES[1]

CA010 phylum (*n.,pl* **phyla**) All members of a phylum have certain common features although they may differ greatly in detail of form and structure, *e.g.* the phylum of Arthropoda includes all animals with jointed legs and exoskeletons; in the traditional system the phylum of Angiospermae includes all plants with flowers, and with ovules formed in a closed cavity. In plant classification a phylum is often called a **division**. —***phyletic*** (*adj.*) ↑ SPECIES[1]

CA011 kingdom (*n.*) The first category for classifying living organisms. The two main kingdoms are the plant and animal kingdoms, (Plantae and Animalia respectively) distinguished by their methods of nutrition. A third kingdom of Protista is often added for the unicellular organisms, such as bacteria, which are difficult to classify as either plants or animals, as they have features found in both. The animal kingdom is divided into three sub-kingdoms: Protozoa, Parazoa, and Metazoa. The plant kingdom can be divided into three sub-kingdoms: Thallophyta, Archegoniatae, and Spermatophyta. ↑ SPECIES[1]

CA012 division (*n.*) A category used in the taxonomy of plants; it is equivalent to a phylum. Either division or phylum is used in different systems of classification. ↑ SPECIES[1]

CA013 tribe (*n.*) (In classification) a subdivision of a sub-family for groups of closely related genera of plants. The name of a tribe ends in **-eae**. ↓ PARAMORPH ↑ TAXONOMY

CA014 paramorph (*n.*) Any variant of a species; a form resulting from environmental factors without changes produced genetically. The term is used particularly to define a variant whose status cannot be defined accurately because of lack of sufficient data. ↑ TRIBE

CA015 classification[2] (*n.*) All living organisms can first be classified into kingdoms, then into phyla, which are sub-divided into classes. Classes are divided into orders, orders are divided into families, families are divided into genera, and genera are divided into species. Each group in the hierarchy can be sub-divided, *e.g.* a phylum is divided into sub-phyla. ↓ BINOMIAL NOMENCLATURE · SYSTEMATICS · PHYLETIC CLASSIFICATION · PHYLOGENY[1] · BIOSYSTEMATICS · KEY · PHYLOGENETIC CLASSIFICATION ↑ TAXONOMY → CLASSIFY

CA016 binomial nomenclature (*n.*) A system of naming all organisms with two Latin names. The second name is a specific name describing the species; the first name is a generic name (name of a genus). The first name is spelt with a capital letter, the second with a small letter, and it is customary to write the name in italics, *e.g. Felis domesticus* is the scientific name for a domestic cat; *Delonis regia* is the scientific name for the Flamboyant tree. ↑ CLASSIFICATION

CA017 systematics (*n. sing.*) The study of the classification of organisms, *i.e.* a term synonymous with taxonomy, but more often used for the study of the phylogeny.

identification, and nomenclature, as well as the classification, of organisms. ↑ CLASSIFICATION[2]

CA018 phyletic classification (*n.*) A classification of plants based on their development from ancestral forms. ↑ CLASSIFICATION[2] → PHENETIC

CA019 phylogeny[1] (*n.*) The evolutionary history and relationships of a group of organisms. —***phylogenetic*** (*adj.*) ↑ CLASSIFICATION[2] → ONTOGENY

CA020 biosystematics (*n. sing.*) The study of the evolution of taxons, often used in experimental methods of identification and nomenclature. ↑ CLASSIFICATION[2]

CA021 key (*n.*) A list of plants or animals arranged in order of botanical classification, with sufficient description under each term to allow an organism to be identified. ↑ CLASSIFICATION[2]

CA022 phylogenetic classification (*n.*) Alternative term for PHYLETIC CLASSIFICATION. ↑ CLASSIFICATION[2]

CA023 coenospecies (*n.,pl.* **coenospecies**) A group of plant species able to form fertile hybrids with each other. ↓ ECOSPECIES · ECOTYPE · DEME · GAMODEME · CYTODEME ↑ TAXONOMY

CA024 ecospecies (*n.,pl.* **ecospecies**) A group of plants containing one or more ecotypes; its members can reproduce to give fertile offspring. A number of ecospecies form a coenospecies. An ecospecies is approximately equivalent to a plant species. ↑ COENOSPECIES

CA025 ecotype (*n.*) An ecotype consists of organisms that have physiological or morphological characteristics adapting them to their habitat. A member of one ecotype can cross freely with a member of other ecotypes. ↑ COENOSPECIES

CA026 deme (*n.*) A basic unit in experimental taxonomy of closely related individuals with clearly definable genetical, cytological, or other characteristics. ↑ COENOSPECIES

CA027 gamodeme (*n.*) A group of individuals categorized by genetic characteristics. ↑ COENOSPECIES → GENETIC

CA028 cytodeme (*n.*) A group of individuals categorized by cytological characteristics. ↑ COENOSPECIES → CYTOLOGICAL

CA029 group[3] (*v.t.,i.*) **1** (*v.t.*) To place physically near together. **2** (*v.t.*) To categorize. **3** (*v.i.*) To come together; to form a group □ *to group together all bacteria to form a category; to group yeasts with the fungi.* ↑ TAXONOMY

CA030 monophyletic (*adj.*) A monophyletic group of animals or plants have descended from a common ancestor, which is a member of the same taxon. ↓ POLYPHYLETIC (An) ↑ TAXONOMY

CA031 polyphyletic (*adj.*) A polyphyletic group of animals or plants have descended from more than one ancestor; convergent evolution may account for the classification, *e.g.* the phylum. Polyzoa are usually considered to be polyphyletic. ↑ MONOPHYLETIC (An)

CA032 phenetic (*adj.*) **1** Describes classifications made on maximum observable similarity. **2** Describes such relationships. ↑ TAXONOMY

CA033 specific[3] (*adj.*) Of or to do with a species, *e.g.* a specific plant cross uses plants of the same species. ↓ INTERSPECIFIC ↑ TAXONOMY

CA034 interspecific (*adj.*) Describes a relation between two species, *e.g.* an interspecific animal hybrid is one produced by parents from two different species. ↑ SPECIFIC[3]

CA035 Protista (*n.pl.*) A group of organisms (in present systems of classification a kingdom) containing organisms of simple biological organization, particularly those which are difficult to classify as either plants or animals, *e.g.* bacteria. Protista is generally taken to include non-cellular (alternatively, unicellular), coenocytic, and multicellular organisms, such as bacteria, protozoa, and slime fungi. —***protistology*** (*n.*) ↓ PROTIST · PROTOZOA (H) · CYST[2] · ENCYST[2] · PROTOZOAN[2] · CYSTIC → BACTERIA · ALGAE · FUNGI · SLIME FUNGI · PROTOPHYTA (H)

CA036 protist (*n.*) Formerly a member of the kingdom of Protista, *e.g.* a bacterium, a protozoan, an alga, a fungus, or a slime fungus; now restricted to protozoans, bacteria, unicellular algae and fungi. ↓ PROTOPHYTA · PROTOPHYTE · PROTOPHYTON · ANTIPHYTA · UNICELL ↑ PROTISTA

CA037 protophyta (*n.pl., sing.* **protophyton**) **1** Unicellular or non-cellular plants, or simple vegetative organisms, including the unicellular algae and fungi. **2** The gametophytes in the antithetic alternation of generations. —PROTOPHYTE (*n.*) PROTOPHYTIC (*adj.*) ↓ ANTIPHYTA[1] ↑ PROTIST → GAMETOPHYTE · ANTITHETIC

CA038 protophyte (*n.*) A member of the protophyta; the term is applied to a single organism or a species. ↑ PROTIST

CA039 protophyton (*n.,pl.* **protophyta**) One unicellular (or non-cellular) independent, individual protophytic organism, isolated for the purpose of observation. ↑ PROTIST

CA040 antiphyta (*n.pl., sing.* **antiphyton**) The sporophytes in the antithetic alternation of generations. —***antiphyte*** (*n.*) ***antiphytic*** (*adj.*) ↑ PROTIST · PROTOPHYTA

CA041 unicell (*n.*) An individual organism consisting of one cell, *e.g.* a member of the phylum Protozoa. ↑ PROTIST

CA042 Protozoa (*n.pl.*) A sub-kingdom of animal classification consisting of one phylum divided into 4 classes based on methods of locomotion. All the protozoa are non-cellular and may possess more than one nucleus. The classes are: Sarcodina which possess pseudopodia (*e.g. Amoeba*); Flagellata which possess flagella (*e.g. Chlamydomanas, Euglena*); Ciliata which possess cilia (*e.g. Paramecium*); Sporozoa

which are inert, with no means of locomotion, almost all its members are parasitic (*e.g. Plasmodium*). —PROTOZOON (*n.*) PROTOZOAN (*n.*) PROTOZOAN (*adj.*) PROTOZOAL (*adj.*) ↓ PROTOZOAN[1] · PROTOZOON · PLASMODROMA ↑ PROTISTA

CA043 protozoan[1] (*n.*) A member of the phylum Protozoa, either a single organism or a species. The protoplasm in a protozoan is differentiated to carry out all life processes, and is not the equivalent of the protoplasm in a cell of a multicellular animal which is specialized for only some processes. ↑ PROTOZOA

CA044 protozoon (*n.,pl.* **protozoa**) One non-cellular (or unicellular) independent, individual organism, indicated for the purpose of observation, *e.g.* ***a*** plasmodia cause malaria; a protozoon enters a red blood cell and reproduces asexually while feeding on the red blood cell. Compare, ***b*** malaria is caused by a protozoan, of the genus *Plasmodium*. Protozoan is also sometimes used in this sense. ↑ PROTOZOA

CA045 Plasmodroma (*n.pl.*) A sub-phylum of Protozoa; its members have either pseudopodia or flagella as locomotory organs, or possess no locomotory organs. The other sub-phylum of Protozoa is Ciliophora. Plasmodroma is not a taxon. ↑ PROTOZOA

CA046 cyst[2] (*n.*) **1** The membrane enclosing a resting protozoan or any other unicell in adverse conditions. **2** A sac-like structure, without an opening, enclosing a liquid, such as lymph, formed by inflammation in body tissues. **3** A bladder; used sometimes of the gall bladder and the urinary bladder. —CYSTIC (*adj.*) CYSTOUS (*adj.*) CYSTOID (*adj.*) ENCYST (*v.*) ↑ PROTISTA

CA047 encyst[2] (*v.t.,i.*) (Of a cell) to enclose or become enclosed in a cyst. ↑ PROTISTA

CA048 protozoan[2] (*adj.*) Of or to do with Protozoa, *e.g.* the protozoan body is considered to be non-cellular. ↓ PROTOZOAL ↑ PROTISTA

CA049 protozoal (*adj.*) Coming or originating from Protozoa, *e.g.* a protozoal infection is one caused by a protozoan. ↑ PROTOZOAN[2]

CA050 cystic (*adj.*) **1** Of or to do with cysts. **2** Of or to do with the gall-bladder or the urinary bladder. ↓ CYSTOUS · CYSTOID ↑ PROTISTA

CA051 cystous (*adj.*) Containing cysts; used to describe a tissue or organ. ↑ CYSTIC

CA052 cystoid (*adj.*) Resembling a cyst. ↑ CYSTIC

CA053 Sarcodina (*n.pl.*) A class of the phylum Protozoa; its members utilize pseudopodia for locomotion and ingestion. The pseudopodia may be short and blunt, or thread-like and anastomosing, or stiff and rod-like. The single cell may be naked, or encased in a simple or complex shell. Reproduction is by binary fission. Its members include *Amoeba*, foraminiferans, and radiolarians. ↓ RHIZOPODA · AMOEBA ↑ PROTISTA → PSEUDOPODIUM[1]

CA054 Rhizopoda (*n.pl.*) **1** A class of the phylum Protozoa; its members are protozoans, which move by means of pseudopodia. **2** Alternative term for Sarcodina. In some classifications, Rhizopoda are a sub-class of Sarcodina, based on the organisms possessing rhizopodia instead of blunt, short pseudopodia; the other subclass is the Actinopoda, which includes the Radiolaria. ↓ RADIOLARIA · FORAMINIFERA ↑ SARCODINA → RHIZOPODIUM

CA055 Radiolaria (*n.pl.*) An order of the class Rhizopoda; the members are planktonic protozoans with internal siliceous skeletons. They are characterized by a middle mass of protoplasm, surrounded by a wall of thin, horn-like substance, and an outer mass of protoplasm from which arise numerous thread-like pseudopodia; the outer mass and pseudopodia are supported by a complex network of siliceous material. The skeletons of silica have been important in forming ooze on the sea-bed, and in forming flint. —***radiolarian*** (*n.*) ***radiolarian*** (*adj.*) ↑ RHIZOPODA

CA056 Foraminifera (*n.pl.*) A group of the class Rhizopoda; its members are mostly marine, forming chambered calcareous shells and possessing fine, thread-like rhizopodia passing through holes (foramina) in the shell. Colonial forms exist, forming shells about 2–3 cm in diameter; the remainder mostly have microscopic shells. The shells of dead animals accumulate and form deep-sea oozes. The shells form an important part of chalk deposits. —***foraminiferan*** (*n.*) ***foraminiferan*** (*adj.*) ↑ RHIZOPODA

CA057 Amoeba (*n.pl.* **amoebae**) A member of a genus of the group Sarcodina. An amoeba is a small unicellular animal which moves by pseudopodia, and presents a constantly changing shape. The flowing of semi-liquid protoplasm effects the change in shape. —AMOEBOID (*adj.*) ↑ SARCODINA → ENGULF[1]

CA058 Flagellata (*n.pl.*) A class of the phylum Protozoa; the members possess flagella which are used for locomotion. ↓ MASTIGOPHORA · TRYPANOSOME · TRYPANOSOMIASIS ↑ PROTISTA → FLAGELLUM

CA059 Mastigophora (*n.pl.*) Alternative term for FLAGELLATA. ↓ FLAGELLATE[1] ↑ FLAGELLATA

CA060 flagellate[1] (*n.*) A member of the class Flagellata. ↑ MASTIGOPHORA

CA061 trypanosome (*n.*) A member of the genus *Trypanosoma*, flagellate protozoa, parasitic in vertebrate blood. A thin, membranous crest, an expansion of the flagellum along one side of the body, assists in the swimming movements of the animal. Trypanosomes have tsetse flies and other biting insects as vectors, and the protozoa are parasitic in the gut of the insect. Trypanosomes cause disease, *e.g.* sleeping sickness in man. —TRYPANOSOMIASIS (*n.*) ↓ TRYPANOSOMA ↑ FLAGELLATA

CA062 Trypanosoma (*n.*) A genus of protozoa described under trypanosome. ↑ TRYPANOSOME

CA063 trypanosomiasis (*n.*) An infection caused by trypanosomes. ↑ FLAGELLATA

CA064 Ciliophora (*n.pl.*) A sub-phylum of Protozoa; its members have cilia as locomotory organs in motile species, and in sedentary species use the cilia for sweeping food into their mouths. In some classifications, Ciliophora are a class in the phylum Protozoa. Ciliophora are divided into two classes (or two groups), Ciliata and Suctoria. —***ciliophoran*** (*n.*) ↓ CILIATA ↑ PROTISTA → CILIUM

CA065 Ciliata (*n.pl.*) A class of the sub-phylum Ciliophora; its members possess cilia throughout their life. ↓ SUCTORIA · CILIATE[1] · INFUSORIA ↑ CILIOPHORA

CA066 Suctoria (*n.pl.*) A class of the sub-phylum Ciliophora; its members possess cilia only in their immature forms. ↑ CILIATA

CA067 ciliate[1] (*n.*) A member of the class Ciliata. ↑ CILIATA

CA068 infusoria (*n.pl.*) **1** The microscopic organisms that appear in an infusion of organic material, *e.g.* hay. The organisms include various Protozoa and Rotifera. **2** An alternative term, now rare, for CILIOPHORA. ↑ CILIATA

CA069 Sporozoa (*n.pl.*) A class of the phylum Protozoa; all its members are parasites; some are amoeboid but all members have no means of locomotion in the adult stage. The majority of the organisms live inside the host's cells at some stage of their life-cycle; there is a characteristic alternation of generations with an asexual form in an intermediate host and a sexual form in a primary host. The life-cycle passes through several well-defined stages, including sporozoite, trophozoite, merozoite, gametocyte, gamete, zygote, *e.g.* in *Plasmodium*, the causative agent of malaria. —***sporozoan*** (*n.*) ***sporozoan*** (*adj.*) ***sporozoic*** (*adj.*) ***sporozous*** (*adj.*) ↑ PROTISTA → SPOROZOITE

CA070 bacterium (*n.pl.*) **bacteria** A unicellular, procaryotic, microscopic organism, surrounded by a cell membrane, distinct from both plants and animals, usually classed with Protista. It possesses a rigid cell wall which may, or may not, be enclosed in a capsule or a slime layer; on the cell wall there may be one or more flagella, or no flagella; the presence of flagella make the bacterium motile; without flagella it is non-motile. Fimbriae may be borne on the cell membrane. In the bacterial cell there is no nucleus and no nuclear membrane; genetic material is in the form of a chromatin thread. Reproduction is generally asexual by binary fission, but conjugation can take place between different strains of some species of bacteria. A few bacteria are autotrophic, using bacteriochlorophyll to obtain energy from sunlight, but most are saprophytic or parasitic. Bacterial activity is responsible for most of the cyclic processes concerning elements in nature, *e.g.* nitrogen and carbon cycles. Bacteria can cause disease in man and other animals, and in plants. The average bacterium is about 0·5–2·0 μm in breadth, with lengths varying up to about 10 μm. Bacteria are widely dispersed, and are found in very large numbers in suitable habitats, *e.g.* 1 cm^3 soil may contain several hundred million bacteria. Bacteria can be either aerobic or anaerobic. —***bacterial*** (*adj.*) ↓ EUBACTERIA · PROTOTROPH · BACTERIOLOGY · MONOTRICHOUS · MESOPHILIC ↑ TAXONOMY → AEROBIC · PROCARYOTIC · FIMBRIA

CA071 eubacteria (*n.pl.*) True bacteria, characterized by rigid cell walls, and the possession of flagella in motile forms; cell division is always by transverse binary fission. The term does not include spirochaetes. ↑ BACTERIUM

CA072 prototroph (*n.*) A strain of micro-organism, *e.g.* alga, bacterium, fungus, having no nutritional requirements other than those required by a wild type of the organism. —***prototrophic*** (*adj.*) ↓ AUXOTROPH (An) ↑ BACTERIUM

CA073 auxotroph (*n.*) A strain of micro-organism which requires growth factors not needed by prototrophs. ↑ PROTOTROPH (An)

CA074 bacteriology (*n.*) The study of bacteria. —***bacteriological*** (*adj.*) ↑ BACTERIUM

CA075 monotrichous (*adj.*) Describes a bacterium with one flagellum. ↓ LOPHOTRICHOUS · AMPHITRICHOUS · PERITRICHOUS · ATRICHOUS ↑ BACTERIUM

CA076 lophotrichous (*adj.*) Describes a bacterium with a tuft of flagella at one end. ↑ MONOTRICHOUS

CA077 amphitrichous (*adj.*) Describes a bacterium with a tuft of flagella at both ends. ↑ MONOTRICHOUS

CA078 peritrichous (*adj.*) Descibes a bacterium with flagella over the entire surface. ↑ MONOTRICHOUS

CA079 atrichous (*adj.*) Describes a bacterium with no flagella. ↑ MONOTRICHOUS

CA080 mesophilic (*adj.*) (Of micro-organisms) having an optimum temperature for growth between 25°C and 40°C. —***mesophile*** (*n.*) ↓ THERMOPHILIC[1] · PSYCHROPHILIC ↑ BACTERIUM

CA081 thermophilic[1] (*adj.*) (Of micro-organisms) having an optimum temperature for growth above 45°C. —THERMOPHILE (*n.*) ↑ MESOPHILIC

CA082 psychrophilic (*adj.*) (Of micro-organisms) having an optimum temperature for growth below 20°C. —***psychrophile*** (*n.*) ↑ MESOPHILIC

Plant Taxonomy

CB001 plant kingdom (*n.*) The group of living organisms with the characteristics of manufacturing all their food from simple inorganic substances, having no power of locomotion. Modern classification systems divide the plant kingdom into two sub-kingdoms, Thallophyta and Embryophyta. The older classification system of plants, *i.e.* Thallophyta, Archegoniata and Spermatophyta, is shown together with the modern classification, *i.e.* Thallophyta and Embryophyta. The diagram (see next page) indicates how the more important taxons, *e.g.* Algae, Bryophyta, etc., are arranged within these two systems. ↓ THALLOPHYTA · EMBRYOPHYTA · MYXOMYCOPHYTA · VASCULAR PLANTS → ALGAE · FUNGI · LICHENES · BRYOPHYTA · PTERIDOPHYTA · GYMNOSPERMAE · ANGIOSPERMAE · DICOTYLEDONEAE → TAXONOMY

CB002 Thallophyta (*n.*) A division of the plant kingdom which includes all plants consisting of a thallus, *e.g.* algae, fungi, lichens, slime fungi. Modern systems of classification have replaced this division by a number of divisions based on evolutionary development. The thallophytes vary in size from microscopic, unicellular plants, to giant seaweeds, up to 70 metres in length. Asexual reproduction is by binary fission, gemmation, or by spores or zoospores. Sexual reproduction can be either isogamous or anisogamous. Modern classification systems regard Thallophyta as one of two sub-kingdoms of plants, the other sub-kingdom being Embryophyta. —THALLOPHYTE (*n.*) ↓ ARCHEGONIATAE · SPERMATOPHYTA ↑ PLANT KINGDOM

CB003 Archegoniatae (*n.pl.*) In some classifications, a sub-kingdom of plants whose members are characterized by possession of an archegonium as a female sex-organ; it is composed of two divisions, Bryophyta and Pteridophyta. Gymnosperms also possess an archegonium, but are not included. Modern systematics leaves Bryophyta as a division (or phylum), and groups Pteridophyta with Spermatophyta in Tracheophyta; Archegoniatae is then discarded. —***archegoniate*** (*n., adj.*) ↑ THALLOPHYTA

CB004 Spermatophyta (*n.pl.*) A sub-kingdom of the plant kingdom; its members are the seed plants. The sub-kingdom is divided into two phyla: Angiospermae and Gymnospermae. In other classifications, the spermatophytes are included with the ferns in a sub-division (sub-phylum), Pteropsida. The spermatophytes include all the trees, shrubs, grasses, and flowering plants. Characteristics of the group are, ***a*** a body organized into root, stem, and leaf; ***b*** a well-developed vascular system; ***c*** the plants are heterosporous; ***d*** a dominant sporophyte generation, and a reduced gametophyte generation; ***e*** they produce seeds, containing an embryo protected by the seed coat. —SPERMATOPHYTE (*n.*) ↑ THALLOPHYTA

CB005 Embryophyta (*n.pl.*) A group of plants, almost all terrestrial; their characteristics are, ***a*** they possess multicellular sex organs; ***b*** they possess an embryo. The group includes the mosses and liverworts, the ferns and the spermatophytes (seed plants). In modern classifications Embryophyta is one of two sub-kingdoms and contains the divisions (or phyla) Bryophyta and Tracheophyta. The other sub-kingdom in this classification is Thallophyta. —***embryophyte*** (*n.*) ↓ TRACHEOPHYTA · PTEROPSIDA · LYCOPSIDA · PSILOPSIDA[1] · SPHENOPSIDA ↑ PLANT KINGDOM

CB006 Tracheophyta (*n.pl.*) A division of the plant kingdom; its members include all plants with a vascular system for conducting water and food solutions. It groups together the older taxons of Pteridophyta and Spermatophyta. The division includes four sub-divisions: Lycopsida, Psilopsida, Pteropsida, Sphenopsida. The sub-division Psilopsida includes primitive vascular plants, most of which are extinct. —***tracheophyte*** (*n.*) ↑ EMBRYOPHYTA

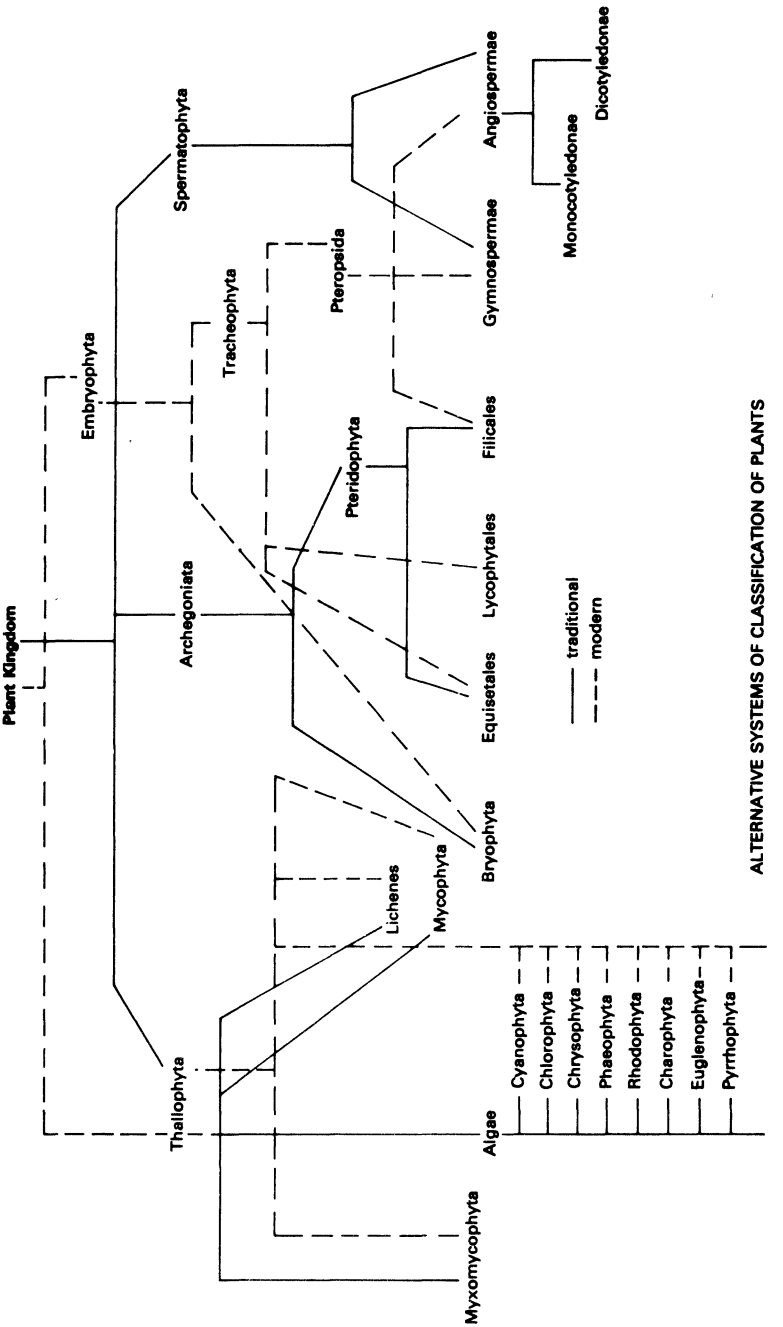
CB007 Pteropsida (*n.pl.*) A sub-division (sub-phylum) of Tracheophyta; its members include the ferns and the spermatophytes. Characteristics of the group are, ***a*** they are sporophytes with true roots, stems and leaves; ***b*** both homosporous and heterosporous forms exist. The sub-division comprises three classes; Filicales or Filicineae, Gymnospermae and Angiospermae. Most classifications restrict the Pteropsida to the ferns. ↑ EMBRYOPHYTA

CB008 Lycopsida (*n.pl.*) A sub-division of Tracheophyta which includes the Lycopodiales. ↑ EMBRYOPHYTA → LYCOPODIALES

CB009 Psilopsida[1] (*n.pl.*) A sub-division of Tracheophyta. ↑ EMBRYOPHYTA → PSILOPSIDA[2]

CB010 Sphenopsida (*n.pl.*) A sub-division of Tracheophyta which includes the Equisetales. ↑ EMBRYOPHYTA → EQUISETALES

CB011 Myxomycophyta (*n.pl.*) A division of the plant kingdom, although the taxonomy is uncertain; the members have both plant and animal characteristics, and have been classified as both Mycetozoa in the class Sarcodina and Myxomycetes in the division Fungi. Characteristics are that, ***a*** its members possess a vegetative form in which the organism forms a plasmodium; ***b*** the plasmodium exhibits amoeboid locomotion and method of feeding; ***c*** during reproduction, the plasmodium forms a sporangium; spores in some genera have cellulose walls; ***e*** the spores germinate to form myxamoebae; ***f*** the myxamoebae fuse to form a


Plant Kingdom
Embryophyta
Thallophyta
Archegoniata
Spermatophyta
Tracheophyta
Pteridophyta
Pteropsida
Angiospermae
Gymnospermae
Dicotyledonae
Monocotyledonae
Filicales
Lycophytales
Equisetales
Bryophyta
Lichenes
Mycophyta
Myxomycophyta
Algae
Cyanophyta
Chlorophyta
Chrysophyta
Phaeophyta
Rhodophyta
Charophyta
Euglenophyta
Pyrrhophyta
traditional
modern
ALTERNATIVE SYSTEMS OF CLASSIFICATION OF PLANTS

zygote; *g* the zygote grows into a plasmodium. The amoeboid plasmodium is an animal characteristic; the formation of spores, especially with cellulose walls, is a plant characteristic. The term is extended in some classifications, to include the cellular slime fungi and the net slime fungi. The myxamoebae, being zoospores, are formed when conditions are adverse. —***myxomychophyte*** (*n.*) ↓ SLIME FUNGI · SLIME MOULD → PLASMODIUM

CB012 slime fungi (*n.pl.*) Alternative term for MYXOMYCOPHYTA (↑).

CB013 slime mould (*n.*) Alternative term for MYXOMYCOPHYTA (↑).

CB014 vascular plants (*n.pl.*) Plants with a vascular system, including the ferns, gymnosperms, and angiosperms; it excludes bryophytes, fungi, and algae. ↓ PHANEROGAMIA · CRYPTOGAMIA ↑ PLANT KINGDOM · TRACHEOPHYTA

CB015 Phanerogamia (*n.pl.*) An old taxon for seed plants (Gymnospermae and Angiospermae), so called because their reproductive organs are clearly visible. Phanerogams are now called **spermatophytes.** —***phanerogam*** (*n.*) ↑ VASCULAR PLANTS

CB016 Cryptogamia (*n.pl.*) An old taxon for all plants other than Phanerogamia, *i.e.* the group comprising Thallophyta, Bryophyta, and Pteridophyta, so called because their reproductive organs are not readily visible. —***cryptogam*** (*n.*) ↑ VASCULAR PLANTS

CB017 Algae (*n.pl.*) A group of simple, photosynthetic plants without stems, roots, or leaves; the plant body is a thallus, either unicellular or multicellular. The multicellular forms are either filamentous, with chains of cells, or flattened and ribbon-like with a complex structure. Characteristics of the plants in this group are that, *a* they are all aquatic plants, marine or fresh-water, or live in damp environments; *b* they have no vascular system; *c* they reproduce by binary division, or conjugation, or by the production of zoospores or male and female gametes; *d* they all possess a form of chlorophyll for photosynthesis. Algae was formerly regarded as a phylum (or division) of the sub-kingdom Thallophyta, composed of eight classes, but the difference between the members is now considered sufficiently great to raise the classes to division (phylum) status. The differences are based on structure: whether it is flagellate or not, the chemical nature of the cell wall, and the photosynthetic pigments. The eight groups are: Charophyta, Chlorophyta, Chrysophyta, Cyanophyta, Euglenophyta, Phaeophyta, Pyrrophyta, Rhodophyta. —ALGA (*n.*) ***algal*** (*adj.*) ***algoid*** (*adj.*) ↓ CYANOPHYTA · CHLOROPHYTA · CHRYSOPHYTA · CHAROPHYTA ↑ PLANT KINGDOM

CB018 Cyanophyta (*n.pl.*) A division of algal plants; its members are the blue-green algae, found mainly in fresh water, although some species are marine. Its characteristics are that, *a* they possess phycocyanin, a blue water-soluble pigment, which gives most members a blue-green colour; other pigments are also present in different proportions in different species, producing different colours, such as red, yellow, green, purple, and black; *b* they store a form of starch, glycogen, not found in other plants, as a food reserve; *c* their cell wall contains cellulose and pectin, and their colonies and filaments are surrounded by a gelatinous sheath; *d* they are unicellular, solitary, or colonial organisms; *e* their cell structure is procaryotic, exhibiting resemblances to bacteria, but thought to be of a distinct evolutionary descent; *f* they are all non-flagellate; *g* they reproduce by binary fission, but evidence exists for a form of conjugation. The members are often planktonic and are widely dispersed; some fix atmospheric nitrogen, and are important in paddy fields. ↓ CYANOPHYCEAE · MYXOPHYTA · BLUE-GREEN ALGAE ↑ ALGAE → PROCARYOTIC

CB019 Cyanophyceae (*n.pl.*) In classifications which regard algae as a division, the blue-green algae are placed in the class Cyanophyceae. ↑ CYANOPHYTA

CB020 Myxophyta (*n.pl.*) Alternative term for CYANOPHYTA. —***myxophyte*** (*n.*) ↑ CYANOPHYTA

CB021 blue-green algae (*n.pl.*) Alternative term for CYANOPHYTA. ↑ CYANOPHYTA

CB022 Chlorophyta (*n.pl.*) A division of algal plants; its members are the green algae, and include *Pleurococcus*, a unicellular organism; *Chlamydomonas*, a unicellular, flagellate organism; *Pandorina*, a colonial organism composed of 16 separate cells; *Spirogyra*, a filamentous organism composed of a chain of cells; *Vaucheria*, a filamentous organism, with strands not divided into cells; sea-lettuce (*Ulva*), with a flat, leaf-shaped thallus. Chlorophyta is the largest division of algae, very diverse in structure. Characteristics of the division are that: *a* their green chlorophyll is not masked by other pigments; *b* they store starch as a food reserve in pyrenoids; *c* they possess a cellulose cell wall. The members are unicellular or multicellular; unicellular members are motile or non-motile and may occur singly or in colonies. Asexual reproduction is by binary division, by fragmentation of the thallus, or by zoospores. Sexual reproduction is by isogametes or anisogametes, with either both gametes or only the male gametes motile. The members are either aquatic (marine or fresh-water), or terrestrial in damp places. —CHLOROPHYTE (*n.*) ↓ CHLOROPHYCEAE · GREEN ALGAE ↑ ALGAE → PYRENOID

CB023 Chlorophyceae (*n.pl.*) In classifications which regard algae as a division, the green algae are placed in the class Chlorophyceae. ↑ CHLOROPHYTA

CB024 green algae (*n.pl.*) Alternative term for CHLOROPHYTA. ↑ CHLOROPHYTA

CB025 Chrysophyta (*n.pl.*) A division of algal plants; its members include diatoms. Characteristics of the division are that, ***a*** an abundance of carotenoid pigments mask chlorophyll giving the organism a yellowish-green to a golden-brown colour; ***b*** oils and leucosin are stored as food reserve; ***c*** the cell wall is of various types; some are composed of pectic substances, others of cellulose, and in many species frequently silicified. The members are aquatic (marine or fresh-water), unicellular or colonial, or filamentous, or amoeboid. Many are planktonic; most are unicellular. ***—chrysophyte*** (*n.*) ↓ PHAEOPHYTA · RHODOPHYTA · RHODOPHYCEAE · BROWN ALGAE · RED ALGAE · FUCOID[1] · BACILLARIOPHYCEAE · DIATOM ↑ ALGAE

CB026 Phaeophyta (*n.pl.*) A division of algal plants; its members are the brown seaweeds, *e.g. Fucus*, found almost entirely in sea water, being inhabitants of the intertidal zone, although one species is pelagic. Characteristics are that, ***a*** they possess fucoxanthin, a brown pigment which masks the colour of chlorophyll; ***b*** stored food includes mannitol; ***c*** the cell wall has two layers, cellulose on the inside and algin, a gelatinous pectic material, on the outside; ***d*** there is a filamentous or complex thallus, the latter consisting of a disc or root-like hold-fast, a stem-like part, and a branched ribbon-like or leaf-like part, often provided with air-bladders; ***e*** asexual reproduction takes place by fragmentation of the thallus or by zoospores, sexual reproduction by motile male gamete and a large non-motile female gamete. The largest members can be up to 60–70 metres in length. ***—phaeophyte*** (*n.*) ↑ CHRYSOPHYTA

CB027 Rhodophyta (*n.pl.*) A division of algal plants; its members consist of the red algae, almost entirely marine organisms, and benthic, *i.e.* found on the sea-bed. Characteristics are that, ***a*** they possess the pigments phycoerythrin (red) and phycocyanin (blue), the former being in greater abundance and masking the chlorophyll present; ***b*** food is stored as a carbohydrate which resembles glycogen; ***c*** cell walls are of two layers, the inner wall of cellulose, the outer of a gelatinous, pectic material; ***d*** there is a filamentous (often branched) or a flat, membranous thallus; ***e*** sexual reproduction is by non-motile gametes. Some species are used to make agar. ***—rhodophyte*** (*n.*) ↑ CHRYSOPHYTA

CB028 Rhodophyceae (*n.pl.*) In classifications which regard algae as a division, the red algae are placed in the class Rhodophyceae. ↑ CHRYSOPHYTA

CB029 brown algae (*n.pl.*) Alternative term for PHAEOPHYTA. ↑ CHRYSOPHYTA

CB030 red algae (*n.pl.*) Alternative term for RHODOPHYTA. ↑ CHRYSOPHYTA

CB031 fucoid[1] (*n.*) A plant of the class Phaeophyta (brown algae). ↑ CHRYSOPHYTA

CB032 Bacillariophyceae (*n.pl.*) A class of algal plants in the division Chrysophyta, they are the diatoms. Characteristics of the class are that, ***a*** chloroplasts contain fucoxanthin, a brown pigment, in addition to chlorophyll; ***b*** the cell wall is composed of pectic substances impregnated with silica and is formed in two halves, one half overlapping the other half; ***c*** asexual reproduction is by binary fission, and sexual reproduction by isogametes. Members are microscopic unicellular aquatic plants existing singly or in colonies. The diatoms and dinoflagellates (Pyrrophyta) together constitute most of the plankton, the primary producers for all aquatic life. ↑ CHRYSOPHYTA → PLANKTON

CB033 diatom (*n.*) A member of the class Bacillariophyceae. ↑ CHRYSOPHYTA

CB034 Charophyta (*n.pl.*) A division of algal plants; its members include the stoneworts. All are found in ponds. Characteristics of the division are, ***a*** there is a multicellular, filamentous thallus; ***b*** the lateral branches of thallus are in whorls; ***c*** rhizoids anchor the thallus to the bottom of the pond; ***d*** members possess multicellular sex-organs, antheridia and oogonia; ***e*** there is a characteristic incrustation with calcium carbonate. Some classifications regard the stoneworts as a subdivision (Charophyceae) of Chlorophyta. ***—charophyte*** (*n.*) ↑ ALGAE

CB035 Euglenophyta (*n.pl.*) A division of algal plants; its members include *Euglena*, and exhibit a close relation to Protozoa; they can be classed as algae or as Protozoa. Characteristics of the division are, ***a*** members possess chlorophyll; ***b*** they store fat and paramylon (a polysaccharide) as a food reserve; ***c*** they are unicellular, without a rigid cell wall; ***d*** they possess 1 to 3 flagella; ***e*** they possess a contractile vacuole; ***f*** they are motile with a peculiar twisting, worm-like motion effected by contraction and expansion of the cell membrane assisted by movement of flagella (euglenoid movement); ***g*** they reproduce by binary fission. ***—euglenophyte*** (*n.*) ↓ PYRROPHYTA · FIRE ALGAE · DINOPHYCEAE · DINOFLAGELLATE ↑ ALGAE

CB036 Pyrrophyta (*n.pl.*) A division of algal plants; its members form the major part of marine and freshwater plankton. Characteristics are, ***a*** its members possess chlorophyll and xanthopylls; ***b*** they store starch, fats and oils as food reserve; ***c*** they are mostly unicellular, with flagella, and motile; ***d*** some are colonial, others are without cell-walls and amoeboid; ***e*** the cell-wall, when present, is composed of cellulose; ***f*** asexual reproduction is by binary fission and by zoospores. In some classifications the Pyrrophyta are classed as Protozoa. ***—pyrrophyte*** (*n.*) ↑ EUGLENOPHYTA

CB037 fire algae (*n.pl.*) Alternative term for PYRROPHYTA. ↑ EUGLENOPHYTA

CB038 Dinophyceae (*n.pl.*) A class of the division Pyrrophyta. Characteristics of the class are, ***a*** its members are motile with two flagella; ***b*** there are various forms of cell wall with interlocking plates, often bearing

long processes. The members are aquatic (marine or freshwater), mostly unicellular, but some are colonial. All are planktonic and adapted to pelagic life. Together with diatoms, the members constitute most of the plankton. ↑ EUGLENOPHYTA → DIATOM · PLANKTON

CB039 dinoflagellate (*n.*) A member of the class Dinophyceae.↑ EUGLENOPHYTA

CB040 fucoid[2] (*adj.*) Of, like, or resembling a fucoid. ↑ ALGAE · FUCOID[1]

CB041 Fungi (*n.pl., sing.* **fungus**) Alternative term for MYCOPHYTA. —FUNGAL, FUNGOID, FUNGICOLOUS, FUNGIFORM, FUNGIVOROUS (*adj.*) ↓ MYCOPHYTA · PHYCOMYCETES · ASCOMYCETES · BASIDIOMYCETES · FUNGI IMPERFECTI · FUNGAL ↑ PLANT KINGDOM → FUNGICOLOUS · FUNGIFORM · FUNGIVOROUS

CB042 Mycophyta (*n.pl.*) A division of the sub-kingdom Thallophyta; its members include the yeasts, mushrooms, moulds and rusts, *i.e.* fungal organisms. Characteristics of the division are, ***a*** its members have eucaryotic cells; ***b*** they lack chlorophyll; ***c*** there are unicellular or coenocytic tubular filaments for the main body of the organism; ***d*** they are saprophytic or parasitic on plants and animals; ***e*** they reproduce asexually and sexually, forming spores in very large numbers. The body of a multicellular fungus is a mycelium and consists of hyphae, with cell walls of cellulose and fungine (a chitinous substance); droplets of oil are stored as food reserves; the hyphae are usually multinucleate, and may, or may not, have septa. Fruiting bodies arise from the hyphae, and produce spores. Fungi play an important part in nature; they break down dead organisms so that bacteria can complete the nitrogen, carbon, and other natural cycles. They are also used in many industrial processes, *e.g.* brewing and baking, and provide important sources of vitamins and proteins. They are very important as agents of disease in plants, and also cause a few diseases of animals. The division comprises four classes: Phycomycetes, Ascomycetes, Basidiomycetes, and Fungi Imperfecti. ↓ MILDEW · MOULD · MYCOLOGY · MYCOGENETICS · MYCOCRINY ↑ FUNGI → COENOCYTE[1] · MYCORRHIZA · HYPHA · FUNGINE · MYCELIUM

CB043 mildew (*n.*) **1** A fungal disease of plants producing a powdery or wool-like growth on the surface of the plant. **2** The fungus causing such a disease. The term is often used as a synonymous term for **mould**, although mildew implies damper circumstances. —***mildewed*** (*adj.*) ↑ MYCOPHYTA

CB044 mould (*n.*) **1** A grey or white superficial growth of a fungus mycelium, looking like wool; usually formed on a dead plant or dead animal substance, and starting the process of decay. **2** (G.S.) Fungal growth. **3** (G.S.) A fungus causing such a growth. —***mouldy*** (*adj.*) ↑ MYCOPHYTA

CB045 mycology (*n.*) The study of fungi. ↑ MYCOPHYTA

CB046 mycogenetics (*n.*) The study of the genetics of fungi. ↑ MYCOPHYTA

CB047 mycocriny (*n.*) The chemical decomposition by fungi of plant remains. ↑ MYCOPHYTA

CB048 Phycomycetes (*n.pl.*) A class of Mycophyta; its members include the white rusts on plants, the downy mildews on fruit and vegetables, the common black mould on bread, and numerous parasites on insects. Characteristics of the class are, ***a*** there are multinucleate hyphae without cross-walls (aseptate) in the vegetative mycelium; ***b*** there are septate hyphae in reproductive structures; ***c*** asexual reproduction is by zoospores, aplanospores, or conidia; sexual reproduction is by conjugation to form thick-walled zygotes. The class is divided into two sub-classes, Oomycetes and Zygomycetes. —***phycomycete*** (*n.*) ↓ ZYGOMYCETES · OOMYCETES · ALGAL FUNGI ↑ FUNGI

CB049 Zygomycetes (*n.pl.*) A sub-class of Phycomycetes. Characteristic asexual reproductivity is by non-motile spores. —***zygomycete*** (*n.*) ↑ PHYCOMYCETES

CB050 Oomycetes (*n.pl.*) A sub-class of Phycomycetes. Characteristic asexual reproduction is by zoospores, the organisms being heterogamous. —***oomycete*** (*n.*) ↑ PHYCOMYCETES

CB051 algal fungi (*n.pl.*) Alternative term for PHYCOMYCETES, so called because of resemblances to some green algae in morphology and reproduction. ↑ PHYCOMYCETES

CB052 Ascomycetes (*n.pl.*) The largest class of Mycophyta; its members include the yeasts, the blue-green moulds, cup fungi, and the ergot fungus. Characteristics of the group are, ***a*** its members possess uninucleate cells and hyphae with cross-walls (septate); ***b*** asexual reproduction is by conidia; sexual reproduction is by fusion of gametangia with the formation of an ascus containing ascospores (yeasts produce naked asci); ***d*** in yeasts, asexual reproduction is by binary fission or by budding; sexual reproduction is by conjugation between two haploid cells. In most species the asci are grouped together in fruit-bodies (variously called apothecium, cleistocarp, perithecium, depending on the species), which are visible to the naked eye. —***ascomycete*** (*n.*) ↓ SAC FUNGI ↑ FUNGI → CONIDIUM · ASCUS · ASCOSPORES · HAPLOID

CB053 sac fungi (*n.pl.*) Alternative term for ASCOMYCETES, so-called because of the sac-shaped sporangium (an ascus) produced during the life-cycle. ↑ ASCOMYCETES

CB054 Basidiomycetes (*n.pl.*) A class of Mycophyta; its members include mushrooms, puffballs, bracket-fungi, and the smuts and rusts parasitic on cereal crops. Characteristics of the class are, ***a*** its members possess septate hyphae in the mycelium; ***b*** they possess during their life-cycle a uninucleate (haploid) mycelium and a binucleate (diploid) mycelium; ***c*** reproduction is sexual by producing

basidiospores in a basidium. In some species basidia are grouped together in fruit-bodies (basidiocarps) and are readily visible, *e.g.* as in mushrooms and puffballs. —***basidiomycete*** (*n.*) ↓ HOMOBASIDIOMYCETES · HETEROBASIDIOMYCETES · CLUB FUNGI ↑ FUNGI → BASIDIUM · BASIDIOSPORE

CB055 Homobasidiomycetes (*n.pl.*) A subclass of Basidiomycetes. They are characterized by the basidia developing directly from a vegetative terminal cell of a hypha: this produces a conspicuous fruiting body as seen in mushrooms, puffballs, and the bracket fungi. ↑ BASIDIOMYCETES

CB056 Heterobasidiomycetes (*n.pl.*) A sub-class of Basidiomycetes characterized by the basidia being formed from the germination of a spore. These organisms include the rusts and smuts, parasites on cereal plants. ↑ BASIDIOMYCETES

CB057 club fungi (*n.pl.*) Alternative term for BASIDIOMYCETES; so-called because of the formation during the life-cycle of a club-shaped reproductive structure (a basidium). ↑ BASIDIOMYCETES

CB058 Fungi Imperfecti (*n.pl.*) A class of Mycophyta; its members are a heterogeneous group of fungi which during their life-cycle have lost the sexual stage. Evidence points to most members being asexual forms of Ascomycetes in which the sexual stage has been lost in evolution. Many members cause fungal diseases in human beings, *e.g.* ringworm, athlete's foot. ↓ DEUTEROMYCETES ↑ FUNGI

CB059 Deuteromycetes (*n.pl.*) Alternative term for FUNGI IMPERFECTI. —***deuteromycete*** (*n.*)

CB060 fungal (*adj.*) Of or to do with fungi. ↓ FUNGOID · FUNGIFORM · MYCOID · MYCOTIC · MYCETOGENETIC · MYCOPHTHOROUS · MYCOTROPHIC ↑ FUNGI

CB061 fungoid (*adj.*) Having the character or the consistency of, or resembling, a fungus. ↑ FUNGAL

CB062 fungiform (*adj.*) Describes a structure shaped like a fungus; an alternative term for FUNGOID, *e.g.*the tongue papillae are fungiform. ↑ FUNGAL

CB063 mycoid (*adj.*) Alternative term for FUNGOID. ↑ FUNGAL

CB064 mycotic (*adj.*) Caused by fungi. ↑ FUNGAL

CB065 mycetogenetic (*adj.*) Produced by a fungus. ↑ FUNGAL

CB066 mycophthorous (*adj.*) Describes a destroyer of fungi, *e.g.* one type of fungus parasitic on, and destroying, another fungus. ↑ FUNGAL

CB067 mycotrophic (*adj.*) Describes plants living symbiotically with a fungus. ↑ FUNGAL → SYMBIOSIS

CB068 Lichenes (*n.pl.*) A division of the sub-kingdom Thallophyta. Its members are dual organisms, the result of symbiosis between a fungus and an alga. The fungus is usually an ascomycete (occasionally a basidiomycete); the alga is a chlorophyte (green alga) or a cyanophyte (blue-green alga). These plants grow on tree trunks, exposed rock, on the ground, on old walls, etc., the rate of growth being extremely slow. The algae found in lichens can exist separately, but the fungi have never been found growing separately. The fungus is the major partner; its hyphae absorb moisture from the air, release acids which decompose rock or soil, releasing inorganic nutrients. The algae may be scattered throughout the lichen, or may be restricted to certain areas; they use the inorganic salts to synthesize organic nutrients. The fungus uses some of these organic nutrients for its own nutrition. Lichenin is stored as a food reserve. Lichens can withstand extremes of physical condition; they play an important part in the initial colonization of rock faces and in forming soil. Asexual reproduction takes place by the formation of soredia on the surface; they are dispersed by various agents. Sexual reproduction takes place in the fungus alone; in most lichens, apothecia or perithecia develop, spores are released and germinate, producing new fungal partners. If an algal partner is available, the lichen is formed; if no algae are present, the fungus dies. The algal partner can, however, reproduce by the same means as its free-living equivalent. ↓ LICHEN · PHYCOBIONT · LICHENIN · CRUSTOSE ↑ PLANT KINGDOM → SOREDIUM

CB069 lichen (*n.*) A member of the Lichenes. Some lichens form an important source of food in Arctic areas, *e.g.* reindeer moss, Iceland moss; others are the source of dyes, *e.g. Roccella*, the source of litmus. A lichen is described by its shape; lichens vary considerably in size, from a millimetre to several centimetres across. ↓ LICHENIZATION · LICHENISM ↑ LICHENES

CB070 lichenization (*n.*) **1** The production of a lichen through symbiosis of a fungus and an alga. **2** The spreading over or encrustation of a surface or a substrate by a lichen. **3** The effect of a lichen on its substrate. ↑ LICHEN

CB071 lichenism (*n.*) The symbiotic relation between fungi and algae. ↑ LICHEN

CB072 phycobiont (*n.*) The algal constituent of a lichen. ↓ MYCOBIONT ↑ LICHENES

CB073 mycobiont (*n.*) The fungal constituent of a lichen. ↑ PHYCOBIONT

CB074 lichenin (*n.*) A polysaccharide found in lichens; also known as ***lichen starch***. ↑ LICHENES

CB075 crustose (*adj.*) Describes a lichen formed as a thin flat crust on its substrate. ↓ FOLIOSE · FRUTICOSE ↑ LICHENES

CB076 foliose (*adj.*) (Of lichens) flat with leaf-like lobes. ↑ CRUSTOSE

CB077 fruticose (*adj.*) (Of lichens) branched; shrub-like. ↑ CRUSTOSE

CB078 Bryophyta (*n.pl.*) A small division (or phylum) of the plant kingdom; its members include the liverworts, mosses, and hornworts; they may be aquatic or epiphytes, or may grow in soil, in damp habitats, or on rocks. Characteristics of the

division are, *a* its members are all small, flat plants, either prostrate or with a short central stem bearing leaves, (some bryophytes have a thallus as the plant body); *b* there is no vascular tissue present; *c* they are anchored to the substratum by rhizoids; *d* they possess antheridia, producing motile, flagellate, male gametes; *e* they possess archegonia, containing a female gamete (a single egg); *f* sexual reproduction is by fusion of gametes forming a capsule containing spores; *g* there is a well-marked alternation of generations. The growing plant is the gametophyte generation; the capsule is the sporophyte generation; the sporophyte depends on the gametophyte for its nutrition. The division comprises three classes: Hepaticae, Musci and Anthocerotae. —***bryophyte*** (*n.*) ↓ HEPATICAE · MUSCI · MOSSY ↑ PLANT KINGDOM → ALTERATION OF GENERATIONS

CB079 Hepaticae (*n.pl.*) A class of Bryophyta; its members are the liverworts; which live in damp places on soil or as epiphytes, or are aquatic. The characteristics of the class are, *a* there is no real differentiation into root, stem, or leaf; *b* the majority of members have leaf-like processes on a short, creeping axis (these are called leafy liverworts), while the thalloid liverworts resemble flat, green seaweeds; *c* they possess single-celled rhizoids which absorb water and inorganic nutrients; *d* both monoecious and dioecious species exist; *e* the capsule lacks stomata and columella; *f* spores from the capsule germinate, to form new liverwort plants; *g* certain species reproduce asexually by gemmae. ↓ ANTHOCEROTAE · LIVERWORT ↑ BRYOPHYTA → GEMMA

CB080 Anthocerotae (*n.pl.*) In some classifications a class of Bryophyta, in other systems an order of Hepaticae; its members are the horned liverworts, or hornworts, mainly growing in tropical and warm temperate regions. Their characteristics are similar to those of Hepaticae except for, *a* each chloroplast contains a pyrenoid; *b* there is a cylindrical capsule, possessing an intercalary meristem near its base; this enables the capsule to continue growth during the life of the gametophyte, and to continue to produce spores; *c* the capsule has a columella and stomata. ↑ HEPATICAE

CB081 liverwort (*n.*) Common name for members of the class Hepaticae ↑ HEPATICAE

CB082 Musci (*n.pl.*) A class of Bryophyta; its members are the mosses, which live in damp places. The characteristics of the class are, *a* its members possess an erect or a prostrate stem; *b* water-conducting cells in strands are situated centrally in the stem; *c* closely arranged leaves, one-cell thick except at the centre, which arise from the stem; *d* multi-cellular rhizoids which anchor stem to substratum; *e* antheridia and archegonia which are borne in separate groups at the tips of the stems; *f* fertilization results in the formation of a capsule containing spores (this is a characteristic of all bryophytes); *g* the spores develop to form a filamentous, or thalloid, protonema; *h* new moss plants develop from lateral buds on the protonema. The Musci differ from Hepaticae in having a more complex capsule, producing a protonema, and in having multicellular rhizoids. The three orders of Musci are the peat mosses, the rock mosses, and the true mosses. Peat is derived mainly from *Sphagnum* and other mosses; *Sphagnum* is also added to soil to increase porosity. ↓ MOSS ↑ BRYOPHYTA → PROTONEMA

CB083 moss (*n.*) Common name for members of the class Musci. —MOSSY (*adj.*) ↑ MUSCI

CB084 mossy (*adj.*) Describes any structure with branching, thread-like outgrowths. ↑ BRYOPHYTA

CB085 Pteridophyta (*n.pl.*) A large division of the sub-kingdom Archegoniatae; [excluded from some classifications (*i.e.* Tracheophyta), and in others made a division of the Plant Kingdom]. Its members include the horsetails, clubmosses and ferns —mainly terrestrial plants. Characteristics of the division are, *a* its members possess true stems, roots, and leaves; *b* they have a well-developed vascular system; *c* there is no cambium; *d* they are non-flowering; *e* there is a well-marked alternation of generations; *f* the conspicuous plant is the sporophyte generation, bearing sporangia on leaves; *g* spores germinate forming prothalli, the gametophyte generation; *h* the gametophyte generation is independent of the sporophyte; it is green, and synthesizes its own food, or is a rhizome feeding saprophytically; *i* the prothallus bears antheridia and/or archegonia; *j* motile, flagellate male gametes fertilize the egg-cell in the archegonium; *k* the zygote develops into a new sporophyte plant. The division contains four extant orders: Equisetales, Lycopodiales, Filicales, and Psilotales. —***pteridophyte*** (*n.*) ↓ PSILOTALES · EQUISETALES · FILICALES ↑ PLANT KINGDOM → ALTERNATION OF GENERATIONS · SPOROPHYTE · GAMETOPHYTE · SPORANGIA

CB086 Psilotales (*n.pl.*) An order of Pteridophyta; its members are primitive vascular plants, related to the order Psilophytales; they are found as epiphytes in tropical areas. Characteristics are, *a* its members are small rhizomatous plants; *b* aerial shoots are branched dichotomously; the vascular system is protostelic or siphonostelic; *d* sporangia are borne in axils of two-lobed sporophylls; *e* the gametophytes lack chlorophyll, are subterranean and mycotrophic; *f* antheridia and archegonia are borne at random on gametophytes. ↓ PSILOPHYTALES · PSILOPSIDA[2] ↑ PTERIDOPHYTA

CB087 Psilophytales (*n.pl.*) An extinct order of Pteridophyta; its members are the oldest land plants known, as they lived about 300 million years ago. Fossils show

that they had no roots, and that their leaves were scale-like. They were small rhizomatous plants, their aerial shoots were branched dichotomously and they had a simple protostelic vascular system; sporangia were borne at the apices of shoots. —***psilophyte*** (*n.*) ↑ PSILOTALES

CB088 Psilopsida[2] (*n.pl.*) A sub-phylum (or sub-division) of Tracheophyta; it includes the orders Psilophytales and Psilotales. This is in a classification which does not recognise Pteridophyta as a phylum. ↑ PSILOTALES

CB089 Equisetales (*n.pl.*) An order of Pteridophyta; its members are the horsetails. In other classifications the horsetails are regarded as a sub-phylum (Sphenopsida) of Tracheophyta. Characteristics of the order are, ***a*** there is a branching rhizome with erect aerial shoots; ***b*** the aerial shoots are hollow, stems are grooved, the outer cells containing silica crystals; ***c*** whorls of tiny scale-like leaves are borne at nodes on the stem (the stem is not hollow at a node); ***d*** the stem is unbranched, or bears whorls of slender branches in leaf axils; ***e*** the stem bears stomata, is green, and carries out photosynthesis; ***f*** there is a well-marked alternation of generations; ***g*** the plant described is the sporophyte generation; spores are formed on sporophylls grouped in cones; the plant is homosporous; ***h*** the gametophyte generation is a prothallus; it can be dioecious or monoecious; ***i*** motile, flagellate male gametes from antheridia fertilize the egg-cell in the archegonium forming an embryo; ***j*** the embryo is first nourished by the prothallus, then develops a root and stem and the prothallus dies. The Equisetales were very common in Carboniferous times, but only 25 species now remain, there being only one extant genus. ↓ LYCOPODIALES ↑ PTERIDOPHYTA → HOMOSPOROUS · PROTHALLUS · MONOECIOUS

CB090 Lycopodiales (*n.pl.*) An order of Pteridophyta; its members include the clubmosses; in other classifications it is an order of Tracheophyta. Characteristics are: ***a*** small, evergreen, upright, or prostrate stems; ***b*** numerous small leaves on stems; ***c*** its members are homosporous with sporangia in axils of sporophylls; ***d*** sporophylls are borne in groups or form a terminal cone; ***e*** a small prothallus, mainly subterranean and mycotrophic. ↑ EQUISETALES → HETEROSPOROUS · MYCOTROPHIC

CB091 Filicales (*n.pl.*) A large order of Pteridophyta, its members are the ferns; in other classifications an order of the sub-phylum Pteropsida. Characteristics are, ***a*** a perennial rhizome, usually underground, but procumbent in some tropical ferns; ***b*** large, conspicuous fronds (leaves) usually divided; ***c*** its members possess vascular bundles; ***d*** sporophylls are the same as ordinary fronds; sporangia are borne, often in sori (groups), on the undersurface of a sporophyll; ***e*** homosporous and heterosporous sporophyte generation; ***f*** the prothalli bear antheridia and archegonia; ***g*** motile, flagellate male gametes fertilize the eggshell in the archegonium; ***h*** the zygote forms an embryo, which is nourished by the prothallus; ***i*** the embryo develops leaves, stems and roots, and the prothallus dies. ↑ PTERIDOPHYTA → FROND[1] · PROCUMBENT

CB092 Gymnospermae (*n.pl*) A division of the Spermatophyta, its members include the conifers; in other classifications, a class of the sub-phylum Pteropsida. Characteristics are, ***a*** the ovules are naked on the surface of the megasporophyll; ***b*** the megasporophylls and microsporophylls are arranged in cones; ***c*** no vessels in the xylem; ***d*** the conducting cells are all tracheids. —***gymnosperm*** (*n.*) ↓ CONIFERALES ↑ PLANT KINGDOM → MEGASPOROPHYLL · XYLEM · TRACHEID

CB093 Coniferales (*n.pl.*) An order of Gymnospermae; its members include practically all the living gymnosperms, *e.g.* pine, cedar, yew, spruce. They are mostly evergreen trees found in temperate climates; the majority are tall. Most species are monoecious with distinctive male and female cones. Characteristics are, ***a*** the microsporophylls are borne directly on the cone axis; ***b*** ovules are borne on the axis of bracts which arise from the cone axis; ***c*** seeds are covered with a thin membrane. —***conifer*** (*n.*) ↓ CYCADALES · CONIFER · CYCAD ↑ GYMNOSPERMAE

CB094 Cycadales (*n.pl.*) An order of Gymnospermae; its members are the most primitive seed plants, with a few living representatives and many fossil representatives; they are found in tropical and subtropical climates. Characteristics are, ***a*** an unbranched stem, either short and partly underground, or columnar or tuberous, up to 20 m in height; ***b*** a crown of fern-like fronds at the apex of the stem; ***c*** dioecious plants; ***d*** the male cone is terminal; the female cone is borne on either side of the stems; ***e*** motile, ciliated male gametes; pollen is dispersed by the wind; ***f*** a considerable amount of pith, the stem exhibiting secondary thickening. —CYCAD (*n.*) ↑ CONIFERALES

CB095 conifer (*n.*) A member of the Coniferales. ↑ CONIFERALES

CB096 cycad (*n.*) A member of Cycadales. ↑ CONIFERALES

CB097 Angiospermae (*n.pl.*) A division of Spermatophyta, its members are all the flowering plants; in other classifications, a class of the sub-phylum Pteropsida. Characteristics are, ***a*** ovules enclosed within an ovary; ***b*** seeds enclosed within a fruit; ***c*** the microsporophylls and megasporophylls borne in flowers; ***d*** gametophyte generation very much reduced; ***e*** non-motile male gametes within a pollen tube, initiated by a pollen grain (a microspore); ***f*** its members possess vessels in the xylem. The angiosperms are divided into two classes (or sub-classes in other classifications), Monocotyledoneae and

Dicotyledoneae. There are many thousands of species of flowering plants grouped into families, based on floral characteristics, but there is little agreement on grouping the species into taxons of a higher rank, except for monocotyledons and dicotyledons. —***angiosperm*** (*n.*) ↓ MONOCOTYLEDONEAE · GLUMIFLORAE ↑ PLANT KINGDOM → DICOTYLEDONEAE · OVULE · XYLEM

CB098 Monocotyledoneae (*n.pl.*) The smaller class (or sub-class in other classifications) of the division of Angiospermae; the class is distinguished from the dicotyledons by possessing only one cotyledon in the embryo. Other characteristics of the class are, ***a*** parallel venation of leaves; ***b*** floral parts are usually in threes or multiples of three; ***c*** vascular tissue in the stem usually consists of scattered vascular bundles; ***d*** there is no secondary thickening of the stem in the majority of species; ***e*** there is no true cambium. Most monocotyledons are small plants (palm trees are an exception). Members of the group include grasses (including cereals), palms, bananas, lilies, tulips and orchids. —***monocotyledon*** (*n.*) MONOCOTYLEDONOUS (*adj.*) ↓ MONOCOTYLEDON ↑ ANGIOSPERMAE → DICOTYLEDONEAE

CB099 monocotyledon (*n.*) A plant which is a member of the class Monocotyledoneae. ↑ MONOCOTYLEDONEAE

CB100 Glumiflorae (*n.pl*) An order of Monocotyledoneae, its members include the grasses (including cereals and bamboo) and sedges. It is characterized by the absence of a perianth and the flower being enclosed in bracts (glumes). ↓ PALMALES · LILIALES · ORCHIDALES · GRAMINALES · PRINCIPES ↑ ANGIOSPERMAE → PERIANTH · GLUME

CB101 Palmales (*n.pl.*) An order of Monocotyledoneae; its members include the palm trees, such as date palm and coconut palm. Stems can vary in height, according to species, from 2 to 35 m; they are usually fibrous, and in many cases the outer surface is formed from the base of leaves shed earlier. Leaves are pinnate or palmate (feather-like or fan-like), with large blades attached to a central mid-rib. ↑ GLUMIFLORAE

CB102 Liliales (*n.pl.*) An order of Monocotyledoneae; its members include the lilies, tulips and the onions. Characterized by, ***a*** the perianth is normally composed of two petaloid whorls, each of three segments; ***b*** leaves are normally upright and linear; ***c*** its members are mainly herbs with bulbs, corms, or rhizomes. ↑ GLUMIFLORAE

CB103 Orchidales (*n.pl.*) An order of Monocotyledoneae; its members include the orchids. Characteristics are, ***a*** irregular flowers; ***b*** six perianth segments; ***c*** elaborate mechanisms for insect pollination; ***d*** they possess pollina; ***e*** many are epiphytes, but some are saprophytes and some terrestial; ***f*** all are perennial herbs, a consistent feature of the groups. ↑ GLUMIFLORAE → POLLINIUM

CB104 Graminales (*n.pl.*) Alternative term for GLUMIFLORAE (↑).

CB105 Principes (*n.pl.*) Alternative term for PALMALES (↑).

CB106 Dicotyledoneae (*n.pl.*) The larger class of Angiospermae; in other classifications, a sub-class. The class is distinguished from the monocotyledons by possessing two cotyledons in the embryo. Other characteristics of the class are, ***a*** net venation of leaves; ***b*** the floral parts are usually in fours or fives or multiples of these numbers; ***c*** the vascular tissue is in stems usually in the form of a ring of open bundles; ***d*** there is secondary thickening of the stem; ***e*** there is a true cambium present. Dicotyledons range in size from large trees, *e.g.* oak and sycamore, to shrubs and small herbs; members include fruit trees, vegetable plants, and ornamental flowers. —***dicotyledon*** (*n.*) ***dicotyledonous*** (*adj.*) ↓ DICOTYLEDON · ARCHICHLAMYDEAE · FAGALES · ROSACEAE ↑ PLANT KINGDOM · MONOCOTYLEDONEAE

CB107 dicotyledon (*n.*) A plant which is a member of the class Dicotyledoneae. ↑ DICOTYLEDONEAE

CB108 Archichlamydeae (*n.pl.*) A sub-class of Dicotyledoneae, in which the flowers lack a perianth or have a calyx. The grouping is useful but does not necessarily indicate a close relationship. In some classifications, Archichlamydeae is taken as a sub-division of Angiospermae, *i.e.* it includes monocotyledons and dicotyledons. The remaining like terms in this set are also used to define useful groups of plants, but are not strictly taxons. ↓ METACHLAMYDEAE · MONOCHLAMYDEAE · SYMPETALAE · POLYPETALAE · INCOMPLETAE · APETALAE ↑ DICOTYLEDONEAE

CB109 Metachlamydeae (*n.pl.*) A sub-class of Dicotyledoneae, in which the flowers have petals joined together (a sympetalous flower). ↑ ARCHICHLAMYDEAE

CB110 Monochlamydeae (*n.pl.*) A sub-class of Dicotyledoneae, in which the flowers have sepals but no petals, or lack a perianth completely. ***Incompletae*** and ***Apetalae*** are alternative terms for Monochlamydeae. ↑ ARCHICHLAMYDEAE

CB111 Sympetalae (*n.pl.*) Alternative term for METACHLAMYDEAE ↑ ARCHICHLAMYDEAE

CB112 Polypetalae (*n.pl.*) A sub-class of Dicotyledoneae, in which the flower has all its petals; these are separate, or free (a polypetalous flower). ↑ ARCHICHLAMYDEAE

CB113 Incompletae (*n.pl.*) Alternative term for MONOCHLAMYDEAE. ↑ ARCHICHLAMYDEAE

CB114 Apetalae (*n.pl.*) Alternative term for MONOCHLAMYDEAE. ↑ ARCHICHLAMYDEAE

CB115 Fagales (*n.pl.*) An order of Dicotyledoneae; its members are all woody trees or shrubs, *e.g.* oak. Both male and female flowers are catkins; the female catkins contain two or three flowers enclosed in persistent bracts. The fruit is a nut. ↓ RANALES · ROSALES ↑ DICOTYLEDONEAE

CB116 Ranales (*n.pl.*) An order of Dicotyledoneae; its members include the buttercup. Most members are herbs, usually with regular bisexual hypogynous flowers; their carpels are free. ↑ FAGALES

CB117 Rosales (*n.pl.*) An order of Dicotyledoneae; it includes the families Rosaceae, Leguminosae, and many others. ↑ FAGALES

CB118 Rosaceae (*n.pl.*) A large family of the order Rosales; its members include rose, plum, apple, strawberry. Characteristics of the family are, ***a*** regular perigynous, or epigynous, flowers; ***b*** its members usually possess five sepals and five petals, and 10, 15 or 20 stamens; ***c*** the number of carpels has a wide range, and in most species they are free; ***d*** the fruits are achenes, follicles, drupes or pomes; ***e*** the ovary is unilocular with two ovules per carpel. The members are trees, shrubs, or herbs. —***rosaceous*** (*adj.*) ↓ LEGUMINOSAE · CACTACEAE · CACTUS ↑ DICOTYLEDONEAE

CB119 Leguminosae (*n.pl.*) A large family of the order Rosales; its members include peas, beans, and clovers, and they range in size from herbs to trees. They are characterized by the fruit nearly always being a legume (pod) and by the root nodules in many species containing nitrogen-fixing bacteria. —LEGUME (*n.*) ***leguminous*** (*adj.*) ↑ ROSACEAE → LEGUME

CB120 Cactaceae (*n.pl.*) A family of the Dicotyledoneae; its members are the cacti, inhabitants of deserts. Characteristics of the family are, ***a*** a large spreading root system; ***b*** fleshy and distended stems capable of storing water; ***c*** leaves reduced to short, protective spines; ***d*** stomata few in number, situated on the stem; ***e*** a thin outer layer of photosynthetic tissue on the stem; ***f*** the flowers are usually large and brightly coloured. ↑ ROSACEAE

CB121 cactus (*n.,pl.* **cacti**) A member of the family Cactaceae; a succulent. ↑ ROSACEAE

Animal Taxonomy

CC001 animal kingdom (*n.*) The animal kingdom contains all those organisms termed animal on two principal criteria, ***a*** that they are incapable of synthesizing food from simple inorganic elements; ***b*** they are capable of true locomotion. Other criteria include rapid and temporary response to stimuli. There are three sub-kingdoms of animals, ***a*** unicellular animals (or Protozoa); ***b*** Parazoa; ***c*** Metazoa. Parazoa and Metazoa are multicellular animals. ↓ INVERTEBRATA · PARAZOA · COELENTERATA · PLATYHELMINTHES · NEMERTEA · NEMATODA · ASCHELMINTHES · ANNELIDA · POLYZOA · ARTHROPODA · INSECTA · ARACHNIDA · MOLLUSCA · BRACHIOPODA · ECHINODERMATA · CHORDATA → PROTOZOA · METAZOA

CC002 Invertebrata (*n.pl.*) A collective term for all animals without backbones. It is not a classification, but is a useful generalization to distinguish such animals from vertebrates □ *the Invertebrata* (*n.pl.*) *do not possess backbones; the Invertebrata* (*n.sing*) *contains numerous phyla* —INVERTEBRATE (*n.*) ***invertebrate*** (*adj.*) ↑ ANIMAL KINGDOM

CC003 Parazoa (*n.pl.*) A sub-kingdom of animals which includes the phylum Porifera (the sponges). The sponges are multicellular, but differ from all other multicellular animals (metazoans), and have been made a separate sub-kingdom. ↓ PORIFERA ↑ ANIMAL KINGDOM

CC004 Porifera (*n.pl.*) The single phylum of the sub-kingdom Parazoa; it contains the sponges. The members are simple, sedentary, aquatic animals lacking any nervous system. Characteristics are, ***a*** a body consisting of a hollow vessel, supported by a skeleton of spicules of lime, silica or fibres of spongin (a protein); the body is perforated by apertures (ostia) for the entry and exit of water; ***b*** they possess collar cells (choanocytes) to create currents of water. There are three classes of sponges, categorized according to the material of the spicules or fibres. ↑ PARAZOA

CC005 sponge (*n.*) A member of the phylum Porifera. ↑ PORIFERA

CC006 Coelenterata (*n.pl.*) A phylum of diploblastic animals; it contains hydroids, medusoids, corals, sea-anemones and comb-jellies. All members are aquatic, mostly marine. Their characteristics are, ***a*** they possess a coelenteron with a single opening; ***b*** they exhibit radial symmetry; ***c*** they possess a very simple nerve network; ***d*** they possess no blood system; ***e*** they possess no excretory system. The two body layers are separated by the mesoglea. —COELENTERATE (*n.*) ***coelenterate*** (*adj.*) ↓ CNIDARIA · HYDROZOA · ACTINOZOA · CTENOPHORA · CORAL ↑ ANIMAL KINGDOM → MESOGLOEA

CC007 Cnidaria (*n.pl.*) A sub-phylum of Coelenterata containing hydroids, medusoids, corals, sea-anemones. The characteristics of the sub-phylum are, ***a*** the body is a polyp or a medusa, generally alternating in the life-cycle; ***b*** locomotion is by muscular activity; ***c*** they possess thread-cells. ↓ SCYPHOZOA · SCYPHOMEDUSAE ↑ COELENTERATA

CC008 Scyphozoa (*n.pl.*) A class of the sub-phylum Cnidaria; its members include the jelly-fish. The main stage of the life-cycle is

the medusa, and the polyp stage is small and inconspicuous, or absent. The medusae are large, free-swimming, and more complex in their structure than the medusae of hydrozoans; the gonads are endodermal. —***scyphozoan*** (*n.*) ***scyphozoan*** (*adj.*) ↑ CNIDARIA

CC009 Scyphomedusae (*n.pl.*) Alternative term for SCYPHOZOA. ↑ CNIDARIA

CC010 Hydrozoa (*n.pl.*) A class of the subphylum Cnidaria; the members are coelenterates with a well-marked alternation of generations, polypoid and medusoid. The characteristics of the class are, ***a*** a simple coelenteron; ***b*** ectodermal gonads; ***c*** individuals are usually small, but fairly large colonies can be formed. Members include *Hydra*, stinging corals, Portuguese man-of-war, *Obelia*. —***hydrozoan*** (*n.*) ***hydrozoan*** (*adj.*) ↓ SIPHONOPHORA ↑ COELENTERATA

CC011 Siphonophora (*n.pl.*) An order of Hydrozoa; its includes the Portuguese man-of-war. The members are floating, colonial coelenterates, exhibiting specialization. In a colony, the individual polyps are specialized for different functions, *e.g.* feeding, swimming, protection, and are frequently arranged around a large air pocket which keeps the colony floating in the water. —***siphonophoran*** (*n.*) ***siphonophoran*** (*adj.*) ↑ HYDROZOA

CC012 Actinozoa (*n.pl.*) A class of the subphylum Cnidaria; its members include the corals and sea-anemones. The characteristics of the class are, ***a*** there is no medusoid stage; ***b*** the polyp is more complex in structure than other coelenterates, possessing mesenteries forming vertical partitions in the coelenteron; ***c*** they possess a stomodaeum formed from an invagination of ectoderm into the coelenteron. —***actinozoan*** (*n.*) ***actinozoan*** (*adj.*) ↓ ANTHOZOA · ALCYONARIA · ZOANTHARIA ↑ COELENTERATA

CC013 Anthozoa (*n.pl.*) Alternative term for ACTINOZOA. —***anthozoan*** (*n.*) ***anthozoan*** (*adj.*) ↑ ACTINOZOA

CC014 Alcyonaria (*n.pl.*) An order of the class Actinozoa; its members include the soft corals. The characteristics of the class are, ***a*** they possess eight tentacles; ***b*** they possess eight mesenteries in the coelenteron. Compare the ordinary corals and sea-anemones, which possess many tentacles and many mesenteries. ↑ ACTINOZOA

CC015 Zoantharia (*n.pl.*) An order of the class Actinozoa; its members include the typical corals and the sea anemones. The characteristics of the class are, ***a*** they possess six, or more than eight, tentacles; ***b*** the tentacles are unbranched. ↑ ACTINOZOA

CC016 Ctenophora (*n.pl.*) A sub-phylum of Coelenterata, sometimes in other classifications considered a separate phylum. The characteristics of the sub-phylum are, ***a*** they are free-living and solitary animals; ***b*** locomotion is by ctenes; ***c*** there are no thread-cells (stinging-cells); ***d*** there is no polypoid or medusoid stage; ***e*** no sedentary stage; ***f*** no asexual reproduction. There are two classes in Ctenophora: Tentaculata (with tentacles) and Nuda (without tentacles). The common name for Ctenophora is comb jellies. —***ctenophoran*** (*n.*) ***ctenophoran*** (*adj.*) ↓ TENTACULATA · NUDA ↑ COELENTERATA → CTENE

CC017 Tentaculata (*n.pl.*) See CTENOPHORA (↑).

CC018 Nuda (*n.pl.*) See CTENOPHORA (↑).

CC019 coral (*n.*) The fused calcareous skeletons of colonial coelenterates. The term also describes the animal, a polyp, which secretes the skeleton. The corals belong to the orders Alcyonaria and Zoantharia. —***coralloid, coralline*** (*adj.*) ↑ COELENTERATA

CC020 Platyhelminthes (*n.pl.*) A phylum of flat, worm-like triploblastic animals; it includes the flukes and tapeworms. The characteristics of the phylum are, ***a*** bilateral symmetry; ***b*** its members possess no coelom; ***c*** the gut, if present, has only one opening; ***d*** parenchymatous tissue derived from mesoderm fills the space between the gut and the body wall; ***e*** excretion is by flame cells; ***f*** they possess a complex hermaphrodite reproductive system. —***platyhelminth*** (*n.*) ***platyhelminthic*** (*adj.*) ↓ TURBELLARIA · FLATWORM ↑ ANIMAL KINGDOM

CC021 Turbellaria (*n.pl.*) A class of Platyhelminthes; the members include planarians. The organisms are mostly free-living, aquatic soft-bodied forms, rarely exceeding 2·5 cm in length; non-aquatic forms live in damp places. The characteristics of the class are, ***a*** a ciliated epidermis; ***b*** locomotion is by gliding caused by the beating of their cilia; ***c*** a protrusible pharynx; ***d*** the gut is branched or unbranched (used in detailed classification as a morphological detail); ***e*** its members possess a simple nervous system. —***turbellarian*** (*n.*) ***turbellarian*** (*adj.*) ↓ TREMATODA · CESTODA · TAPEWORM ↑ PLATYHELMINTHES → PLANARIAN

CC022 Trematoda (*n.pl.*) A class of Platyhelminthes; its members include the flukes, and all members are parasites. Characteristics of the class are, ***a*** a thick, structureless cuticle; ***b*** two suckers for attachment to the host; ***c*** a forked gut leading from a mouth; ***d*** a complicated life-history, with usually two or more hosts, each necessary for a separate stage of development; ***e*** several larval stages. —***trematode*** (*n.*) ***trematode*** (*adj.*) ↑ TURBELLARIA → FLUKE[2]

CC023 Cestoda (*n.pl.*) A class of the phylum Platyhelminthes; all members are flatworms parasitic in the gut of mammals, commonly known as tapeworms. Its members are characterized by a body consisting of numerous proglottides, or segments, each proglottis being functionally separate from the remainder; the body grows from a scolex. —***cestode*** (*n.*) ***cestode*** (*adj.*) ↑ TURBELLARIA → SCOLEX · PROGLOTTIS

CC024 tapeworm (*n.*) Alternative term for a **cestode**. The ripe proglottides at the end of the tapeworm contain fertilized eggs which are passed out in faeces. In a suitable secondary animal host (*e.g.* pigs, cattle), the eggs develop into onchospheres (embryos with six hooks). The embryos develop into a larval stage, a bladder-worm, in which an invaginated proscolex is inside a bladder. When the bladder-worm is eaten by man, the primary host, the bladder is dissolved, the proscolex evaginates and forms a scolex. The scolex becomes attached to the man's gut, and proglottides grow from it. ↑ TURBELLARIA → PROGLOTTIS · ONCHOSPHERE · PROSCOLEX · SCOLEX · INVAGINATE

CC025 flatworm (*n.*) Alternative term for a PLATYHELMINTH. ↓ PLANARIAN · FLUKE[2] ↑ PLATYHELMINTHES

CC026 planarian (*n.*) A turbellarian possessing an intestine with three branches. ↑ FLATWORM · TURBELLARIA

CC027 fluke[2] (*n.*) A member of the class Trematoda; a parasitic, dioecious flatworm. The adults are parasites in the liver, gut, lung, blood vessels or lymphatic vessels of a vertebrate. Eggs are passed out with faeces from the host, and larvae (miracidiae) emerge to become parasites in snails (the intermediate host). In the snail the miracidiae reproduce asexually and develop into rediae (another larval form). The rediae develop into cercariae, immature flukes, which emerge from the snail. The cercariae are infective to animals, which may be the primary host (in which case, the cercariae mature into adults), or (in some species of fluke) another intermediate host ↑ FLATWORM → TREMATODA

CC028 Nemertea (*n.pl.*) A small phylum of marine worms, showing similarities with the platyhelminths in being flattened and possessing flame cells. The differences from platyhelminths include, ***a*** possessing a circulatory blood system; ***b*** a gut with both a mouth and an anus; ***c*** a peculiar proboscis which lies in a cavity above the gut and is protrusible; ***d*** a simpler reproductive system. Its members include proboscis (or ribbon) worms. ↓ NEMERTINEA ↑ ANIMAL KINGDOM

CC029 Nemertinea (*n.pl.*) Alternative term for NEMERTEA. —***nemertinean, nemertine*** (*n.*) ***nemertine*** (*adj.*) ↑ NEMERTEA

CC030 Nematoda (*n.pl.*) A phylum of invertebrate animals, not closely related to each other, but with certain common characteristics, *e.g.* ***a*** cylindrical unsegmented bodies; ***b*** acoelomate structure; ***c*** a gut composed of mouth, pharynx and an intestinal tube; ***d*** three to six lips round the mouth. Members of the phylum include roundworms, threadworms, and hookworms, all parasitic on animals, and eelworms, parasitic on plants; many nematodes are also free-living in soil and in water. Nematodes are considered in some classifications to be a class of the phylum Aschelminthes, an attempt to solve a problem in taxonomy in which fewer characteristics are needed to define the phylum than are needed to define Nematoda. —***nematode*** (*n.*) ***nematode*** (*adj.*) ↓ ROUNDWORM · ASCAROIDEA · FILARIASIS ↑ ANIMAL KINGDOM → ASCHELMINTHES

CC031 roundworm (*n.*) Alternative term for **nematode**. ↓ FILARIA · MICROFILARIAE · HOOKWORM · THREADWORM ↑ NEMATODA

CC032 filaria (*n.,pl.* **filariae**) One of a group of thread-like nematode worms; they are parasitic on man and other mammals, living in the lymphatic system or in the bloodstream. Adult females produce microfilariae which appear in the peripheral bloodstream. The microfilariae are sucked up by mosquitoes and some other biting insects taking a blood meal, and migrate to the insect's wing muscles, and there develop into juveniles. The juvenile filariae travel to the salivary glands of the mosquito and are injected into the bloodstream; they migrate to the lymphatic system, can develop into adults, and the cycle starts again. Filariae can cause elephantiasis. —***filarial*** (*adj.*) ↑ ROUNDWORM

CC033 microfilariae (*n.pl., sing.* **microfilaria**) See FILARIA. ↑ ROUNDWORM

CC034 hookworm (*n.*) Small nematode parasites of man; the adults are about 2–3 cm long and the sexes are separate. The parasite has hooks arranged round its mouth, allowing it to fasten onto the wall of the intestine. The adults copulate, and produce eggs, which are passed out with faeces. The eggs hatch, larvae are liberated; these larvae moult, form motile larvae which penetrate the skin of naked feet, and enter the bloodstream. The larvae eventually arrive in the gut, fasten onto the gut wall and develop into adults, and repeat the cycle of infestation. Hookworms are common in most tropical and sub-tropical regions of the world. Infestations cause malaise and anaemia, and are a serious social problem. ↑ ROUNDWORM

CC035 threadworm (*n.*) A member of the class Nematomorpha. The organisms are about 1 cm long and are parasitic on the human colon. The sexes are separate and copulate to produce fertile eggs. The female descends the colon at night, and lays her eggs in the folds of the skin round the anus. The eggs are transferred to the mouth by the fingers, or by dispersal in air. The eggs are ingested, descend to the stomach and develop into adults. ↑ ROUNDWORM

CC036 Ascaroidea (*n.pl.*) A class of Nematoda; its members include the parasitic roundworm in man and other mammals. Characteristics include having three lips. ↓ NEMATOMORPHA ↑ NEMATODA

CC037 Nematomorpha (*n.pl.*) A class of the phylum Nematoda; it contains the threadworms. ↑ ASCAROIDEA · THREADWORM

CC038 filariasis (*n.*) Infection from filariae. ↓ ELEPHANTIASIS ↑ NEMATODA

CC039 elephantiasis (*n.*) A heavy infestation of adult filarial worms causes elephantiasis, a disease in which a limb swells to gross proportions. The adult filarial worms live in the lymph vessels and lymph glands of the host, and the obstruction of the lymphatic system caused by a heavy infestation produces the swelling. Microfilariae cannot develop into adults in their host; they must complete their life-cycle in a secondary host. Elephantiasis can only be caused by repeated infestation of juvenile filariae. ↑ FILARIASIS

CC040 Aschelminthes (*n.pl.*) A phylum of mainly small and microscopic animals, with the exception of some nematodes; all members are vermiform and bilaterally symmetrical. The gut is a tube within a tubular body, and a cuticle encloses the body. There are no circulatory or respiratory organs; except for nematodes, all use protonephridia for excretion. The aschelminths are typically pseudocoelomate. Most members are dioecious, and most are aquatic. There are six classes in the phylum including the Rotifera and Nematoda. Some classifications elevate the aschelminth classes to phylum status. —***aschelminth*** (*n.*) ***aschelminth*** (*adj.*) ↓ ROTIFERA ↑ ANIMAL KINGDOM

CC041 Rotifera (*n.pl.*) Originally a phylum, now considered as either the only class of the phylum Trochelminthes, or a class of the phylum Aschelminthes. The members are aquatic acoelomate animals, called wheel animalcules, because of their mode of locomotion. Characteristics are, ***a*** a crown of cilia at the anterior end, which acts as a locomotory organ and also collects food; the ciliated crown resembles a rotating wheel when beating (hence wheel animalcule); ***b*** a complete alimentary canal; ***c*** a nervous system; ***d*** excretion is by flame cells; ***e*** there is no blood system; ***f*** sexual reproduction is by separate males and females, although parthenogenesis takes place in many species as mature males are rarer than females. —***rotifer*** (*n.*) ↓ TROCHELMINTHES ↑ ASCHELMINTHES

CC042 Trochelminthes (*n.pl.*) A phylum of small aquatic animals, unsegmented, with cilia as locomotory organs. —***trochelminth*** (*n.*) ***trochelminth*** (*adj.*) ↑ ROTIFERA

CC043 Annelida (*n.pl.*) A phylum of segmented worms; its members include earthworms, bristle-worms, leeches. Characteristics of the phylum are, ***a*** a clearly segmented metameric body; ***b*** its members possess a coelom and a blood system; ***c*** excretion is by nephridia; ***d*** there is a well-defined nervous system; ***e*** a thin, moist cuticle is used in respiration. The main classes of the phylum are Chaetopoda and Hirudinea. —***annelid*** (*n.*) ***annelid*** (*adj.*) ↓ CHAETOPODA · HIRUDINEA ↑ ANIMAL KINGDOM

CC044 Chaetopoda (*n.pl.*) A class of Annelida; it is divided into two sub-classes, Oligochaeta and Polychaeta. Members are characterized by a spacious coelom, clear metameric segmentation, and the presence of chaetae or setae. —***chaetopod*** (*n.*) ***chaetopod*** (*adj.*) ↓ POLYCHAETA · OLIGOCHAETA ↑ ANNELIDA → CHAETA · SETA

CC045 Polychaeta (*n.pl.*) A sub-class of Annelida. Members are segmented worms, with many chaetae, arranged in bundles. Each segment possesses a pair of parapodia, with the bundles of chaetae projecting from the parapodia. They are marine worms; examples include the ragworm (*Nereis*). —***polychaete*** (*n.*) ***polychaete*** (*adj.*) ↑ CHAETOPODA

CC046 Oligochaeta (*n.pl.*) A sub-class of Annelida. Members are segmented worms with only a few chaetae, arranged in four double rows along the ventral and lateral sides of the body. They are terrestrial, hermaphrodite with a clitellum, and cross-fertilize. A common example is the earthworm, *e.g. Lumbricus.* —***oligochaete*** (*n.*) ***oligochaete*** (*adj.*) ↑ CHAETOPODA → CLITELLUM

CC047 Hirudinea (*n.pl.*) A class of Annelida; its members are marine, freshwater and terrestrial leeches. The characteristics of the class are, ***a*** suckers at posterior and anterior ends; ***b*** a relatively short segmented body, but the segments do not correspond to external rings as in earthworms; ***c*** there are no chaetae or setae; ***d*** the coelom is reduced to narrow tubes, and the rest of the body is filled with tissue; ***e*** the mouth is equipped with teeth (for tearing); ***f*** they are hermaphrodite with a clitellum and internal fertilization; ***g*** the eggs develop in a cocoon. Some leeches are blood-suckers, and they have a number of pouches in the gut in which blood is stored, stretching the body. ↑ ANNELIDA

CC048 Polyzoa (*n.pl.*) Small aquatic, and usually sedentary, colonial animals, formerly a phylum, divided into two classes; Ectoprocta and Endoprocta. These two taxons are now raised to phylum status, as the Polyzoa were considered a polyphyletic group. Superficially a polyzoan resembles a hydroid coelenterate. Characteristics of the group are, ***a*** they possess a lophophore; ***b*** they possess ciliated tentacles around the mouth; ***c*** they possess an anus near the mouth; ***d*** they sometimes possess a horny or calcareous skeleton. —***polyzoan*** (*n.*) ***polyzoan*** (*adj.*) ↓ BRYOZOA ↑ ANIMAL KINGDOM → LOPHOPHORE · POLYPHYLETIC

CC049 Bryozoa (*n.pl.*) Alternative term for POLYZOA. —***bryozoan*** (*n.*) ***bryozoan*** (*adj.*) ↓ ECTOPROCTA · ENDOPROCTA · ENTOPROCTA

CC050 Ectoprocta (*n.pl.*) A small class (sometimes rated a phylum) of coelomate marine animals, normally colonial They possess shell-like exoskeletons, either hard or gelatinous, which join together to form branched fern-like structures, fixed to rocks and sea-weed. The body of the animal emerges from its case and the animal feeds by catching small organisms with tentacles situated around its mouth, this food-catching organ is a lophophore. —***ectoproct***

(*n.*) ↑ BRYOZOA → LOPHOPHORE

CC051 Endoprocta (*n.pl.*) A small class (or a phylum) of acoelomate aquatic animals, usually colonial. They resemble ectoprocts in most morphological details, and are differentiated by having an anus inside the ring of tentacles around the mouth. —***endoproct*** (*n.*) ↑ BRYOZOA

CC052 Entoprocta (*n.pl.*) Alternative term for ENDOPROCTA.

CC053 Arthropoda (*n.pl.*) A very large phylum, the largest in the animal kingdom; all of its members are invertebrates. The phylum is divided into the following classes: Insecta, Arachnida, Crustacea, Myriapoda. Characteristics of the phylum are, ***a*** jointed legs; ***b*** a hard exoskeleton, chitinous or calcareous; ***c*** a reduced coelom; ***d*** the body cavity is a haemocoel. —ARTHROPOD (*n.*) ***arthropodal*** (*adj.*) ↓ MYRIAPODA · CRUSTACEA · ARTHROPOD · INSECTA · ARACHNIDA · MOLLUSCA ↑ ANIMAL KINGDOM → HAEMOCOEL

CC054 Myriapoda (*n.pl.*) A class of Arthropoda; it includes the centipedes and the millipedes. The character of the class are, ***a*** a long segmented body; ***b*** a distinct head; ***c*** many legs; ***d*** one pair of antennae; ***e*** at least one pair of maxillae; ***f*** breathing is by tracheae. The members are terrestrial. Centipedes have one pair of legs per segment; millipedes have two pairs of legs per segment, each segment being two embryonic segments fused together. There are important biological differences between centipedes and millipedes, and in some systems of classification they are put in separate classes. —***myriapod*** (*n.*) ↓ CHILOPODA · DIPLOPODA ↑ ARTHROPODA

CC055 Chilopoda (*n.pl.*) The centipedes, an order of the class Myriapoda; in some classifications they are elevated to a class. Characteristics of Chilopoda are, ***a*** one pair of legs per segment; ***b*** usually flattened bodies; ***c*** they are carnivorous. —***chilopod*** (*n.*) ***chilopod*** (*adj.*) ↑ MYRIAPODA

CC056 Diplopoda (*n.pl.*) The millipedes, an order of the Class Myriapoda; in some classifications they are elevated to a class. Characteristics of Diplopoda are, ***a*** two pairs of legs per segment; ***b*** a usually cylindrical body; ***c*** they are herbivorous. —***diplopod*** (*n.*) ***diplopod*** (*adj.*) ↑ MYRIAPODA

CC057 Crustacea (*n.pl.*) A large class of the phylum Arthropoda; its members are mostly aquatic. Characteristics of the class are, ***a*** two pairs of antennae, the first pair called antennules; ***b*** three pairs of mandibles; ***c*** biramous (forked) appendages; ***d*** the aquatic members have gills which are parts of limbs, or are modified limbs; ***e*** cuticle is often calcareous, and may be developed into a carapace; ***f*** two pairs of maxillae; ***g*** compound eyes Members of the class include crabs, water-fleas, shrimps, barnacles and woodlice (the only true terrestrial members) —***crustacean*** (*n.*) ***crustacean*** (*adj.*) ***crustaceous*** (*adj.*) ↓ BRANCHIOPODA · DECAPODA[1] · ISOPODA · AMPHIPODA ↑ ARTHROPODA

CC058 Branchiopoda (*n.pl.*) A sub-class of Crustacea; its members are small aquatic animals, and include the water-fleas and freshwater shrimps. Characteristics are, ***a*** they possess many flat, leaf-like feet; ***b*** appendages used for swimming which bear gills for respiration and are also used for feeding. —***branchiopod*** (*n.*) ↑ CRUSTACEA

CC059 Decapoda[1] (*n.pl.*) An order of the class Crustacea; its members include crabs, lobsters, crayfish; they are mainly free-swimming marine animals. Characteristics of the order are, ***a*** five pairs of appendages on the thorax which are walking legs; ***b*** the first pair of appendages is modified into claws; ***c*** the antennules are biramous. —***decapod*** (*n.*) ***decapod*** (*adj.*) ↑ CRUSTACEA

CC060 Isopoda (*n.pl.*) An order of Crustacea; it contains the only terrestrial members of the order, the woodlice; it also contains marine and freshwater members. The members of the order generally have a flat body with six or more segments, eyes with fixed or no stalks, and isopodous legs, *i.e.* legs which are similar to each other. —***isopod*** (*n.*) ***isopod*** (*adj.*) ↑ CRUSTACEA

CC061 Amphipoda (*n.pl.*) An order of the sub-class Branchiopoda; it includes the freshwater shrimps. Characteristics of Amphipoda are, ***a*** flattened bodies; ***b*** no carapace. Some free-living members are aquatic, others terrestrial, and some members are parasitic. ↑ CRUSTACEA

CC062 arthropod (*n.*) A member of the phylum Arthropoda, *e.g.* an insect, a crustacean, an arachnid, or a myriapod. ↓ INSECT · CRUSTACEAN · ARACHNID · MYRIAPOD ↑ ARTHROPODA

CC063 insect (*n.*) A member of the class Insecta ↓ INSECTA ↑ ARTHROPOD

CC064 crustacean (*n.*) A member of the class Crustacea. ↑ ARTHROPOD · CRUSTACEA

CC065 arachnid (*n.*) A member of the class Arachnida. ↑ ARTHROPOD → ARACHNIDA

CC066 myriapod (*n.*) A member of the class Myriapoda. ↑ ARTHROPOD · MYRIAPODA

CC067 Insecta (*n.pl.*) A very large class of Arthropoda, the largest in the animal kingdom. Most insects are terrestrial and breathe by tracheae. Characteristics are, ***a*** three pairs of legs on the thorax; ***b*** three distinct body parts (head, thorax, abdomen); ***c*** one pair of antennae on the head; ***d*** compound eyes; ***e*** mouth parts for feeding; ***f*** most have two pairs of wings, borne on the thorax. Insects undergo complete or incomplete metamorphosis and ecdysis (moulting). Insects are classified in two subclasses, Apterygota, or wingless insects, and Pterygota, or winged insects. —***insect*** (*n.*) ***insectile*** (*adj.*) ↓ HEXAPODA · APTERYGOTA · ENDOPTERYGOTA[1] · MOSQUITO · ENTOMOLOGY · EXOPTERYGOTA[2] ↑ ARTHROPODA → MOUTH PARTS · ECDYSIS

CC068 Hexapoda (*n.pl.*) Alternative term for INSECTA. —***hexapod*** (*n.*) ***hexapod*** (*adj.*) ↓ PTERYGOTA ↑ INSECTA

CC069 Pterygota (*n.pl.*) A large sub-class of the class Insecta, divided into two sub-

groups, Exopterygota and Endopterygota. It includes all the winged insects, and some wingless insects whose ancestors were winged, but have lost their wings in adaptation to a parasitic life. The class includes all insects other than the Apterygota. —***pterygote*** (*n.*) ***pterygote*** (*adj.*) ↑ HEXAPODA

CC070 Apterygota (*n.pl.*) A sub-class of Insecta. On hatching the larvae resemble the adults in all but size; they do not undergo metamorphosis, but undergo direct development. Both adults and larvae are wingless and are considered to be descended from wingless ancestors. Contrast other wingless insects, which have descended from winged ancestors and are classed with the winged insects. —***apterygote*** (*n.*) ***apterygotous, apterigial*** (*adj.*) ↑ INSECTA · PTERYGOTA (An)

CC071 Endopterygota[1] (*n.pl.*) A sub-class of Insecta; its members are characterized by, ***a*** complete metamorphosis; ***b*** the larvae are completely unlike the adults; ***c*** the wings develop inside the body of the larva. —***endopterygote*** (*n.*) ***endopterygotic*** (*adj.*) ↓ COLEOPTERA · DIPTERA · HYMENOPTERA · TRICHOPTERA · NEUROPTERA · LEPIDOPTERA · SIPHONAPTERA ↑ INSECTA → HOLOMETABOLA

CC072 Coleoptera (*n.pl.*) An order of Endopterygota; its members include the beetles and weevils. Characteristics are, ***a*** horny forewings (elytra); ***b*** membranous hind wings. —***coleopterous*** (*adj.*) ↑ ENDOPTERYGOTA[1]

CC073 Diptera (*n.pl.*) A large order of Endopterygota; its members include the house-fly, bluebottle, mosquito and tsetse fly. Characteristics of the order are, ***a*** they possess only one pair of wings; ***b*** the hind-wings are modified as halteres; ***c*** legless larvae, many of which are aquatic; ***d*** highly specialized mouth parts adapted for blood-sucking or for sucking plant juices; ***e*** the pupae are often protected within a barrel-like puparium. —***dipteran*** (*n.*) ***dipteran, dipteral, dipterous*** (*adj.*) ↑ ENDOPTERYGOTA[1] → HALTERES

CC074 Hymenoptera (*n.pl.*) A large order of Endopterygota; it includes bees, wasps, and ants. Characteristics of the order are, ***a*** generally legless larvae; ***b*** two pairs of membranous wings coupled together in adults; ***c*** an ovipositor, sometimes modified into a sting. Some members are social insects with highly specialized forms of adults for communal life. —***hymenopteran*** (*n.*) ***hymenopteran,*** HYMENOPTEROUS (*adj.*) ↑ ENDOPTERYGOTA[1]

CC075 Trichoptera (*n.pl.*) An order of Endopterygota; its members include the caddis flies. The larvae are aquatic and in the majority of species build cases made of wood, small stones, leaves or sand, in which they conceal their soft bodies. The body and wings of the adult are covered with fine hairs. —***trichopteran*** (*n.*) ***trichopteran, trichopterous*** (*adj.*) ↑ ENDOPTERYGOTA[1]

CC076 Neuroptera (*n.pl.*) An order of Endopterygota, containing lacewing flies, ant-lion flies and alderflies. Its members possess two similar pairs of delicate membranous wings, with minute venation. The larvae of some species are aquatic; all larvae are carnivorous, *e.g.* lacewing larvae feed on aphids. —***neuropteran*** (*n.*) ***neuropteran, neuropterous*** (*adj.*) ↑ ENDOPTERYGOTA[1]

CC077 Lepidoptera (*n.pl.*) An order of Endopterygota, containing butterflies and moths. Characteristics of the order are, ***a*** two pairs of large wings with scales, the scales being responsible for the brightly coloured wings common to the order; ***b*** a body covered in scales; ***c*** complete metamorphosis, with a caterpillar as the larval stage; ***d*** a specialized proboscis (in adults) for sucking plant nectar; when not feeding it is carried coiled under the head; ***e*** the caterpillars have mandibles and feed on plants, mainly leaves. —***lepidopteron*** (*n.*) ***lepidopterous, lepidopteron*** (*adj.*) ↑ ENDOPTERYGOTA[1]

CC078 Siphonaptera (*n.pl.*) An order of Endopterygota; its members include the fleas. These insects are secondarily wingless, *i.e.* their ancestors were winged, because of adaptation to a parasitic mode of life on birds and mammals. The characteristics of the order are, ***a*** bodies laterally flattened for living in fur and feathers; ***b*** mouth parts adapted for blood sucking; ***c*** well-developed legs, giving great powers of jumping. —***siphonapteran*** (*n.*) ***siphonapteran, siphonapterous*** (*adj.*) ↑ ENDOPTERYGOTA[1]

CC079 mosquito (*n.pl.* **mosquitoes**) An insect of the order Diptera, family Culicidae, extremely important in the spread of disease. The female sucks blood, but the male sucks plant juices. The mouth parts of the female are highly specialized to inject saliva into the victim to prevent blood from clotting as it is drawn up into the gullet. The insect undergoes complete metamorphosis, and the pupal stage differs from that of most insects in that the pupa can move, although it cannot feed. Eggs are laid on water, and both larval and pupal stages are aquatic. The causative agents of disease are injected with the saliva, *e.g. Plasmodium*, which causes malaria. ↑ INSECTA → DIPTERA

CC080 entomology (*n.*) The study of insects. —***entomologist*** (*n.*) ***entomological*** (*adj.*) ↑ INSECTA

CC081 Exopterygota[2] (*n.pl.*) A sub-class of Insecta. Members are characterized by, ***a*** incomplete metamorphosis; ***b*** the larvae undergo successive moults, becoming progressively larger and developing into the imago, *i.e.* there is no pupal stage; ***c*** the wings develop outside the body of the larva. —***exopterygote*** (*n.*) ***exopterygotic*** (*adj.*) ↓ DERMAPTERA · ANOPLURA · SIPHUNCULATA · MALLOPHAGA · DICTYOPTERA · ODONATA · ORTHOPTERA · ISOPTERA · HEMIPTERA · EPHEMEROPTERA ↑ INSECTA → HETEROMETABOLA · HEMIMETABOLA

CC082 Dermaptera (*n.pl.*) A small order of

the class Exopterygota, it contains the earwigs. Characteristics are, ***a*** short, stiff, forewings; ***b*** fan-like hindwings folded under forewings; ***c*** powerful anal cerci used as pincers. ↑ EXOPTERYGOTA[2]

CC083 Anoplura (*n.pl.*) An order of Exopterygota; its members are ectoparasites of mammals, and have mouth parts adapted for sucking blood. The order includes the human louse. —***anopluran*** (*n.*) ***anopluran*** (*adj.*) ↑ EXOPTERYGOTA[2] → ECTOPARASITE

CC084 Siphunculata (*n.pl.*) Alternative term for ANOPLURA. ↑ EXOPTERYGOTA[2]

CC085 Mallophaga (*n.pl.*) An order of Exopterygota; its members include lice and ectoparasites on birds. The lice act as scavengers, feeding on bits of feather, skin, etc.; they do not generally pierce the skin. The Mallophaga possess biting mouth parts, and are sometimes called biting lice. Some members feed on the host's blood. —***mallophagan*** (*n.*) ***mallophagan*** (*adj.*) ↑ EXOPTERYGOTA[2]

CC086 Dictyoptera (*n.pl.*) An order of Exopterygota; its members include the cockroaches and mantids. Characteristics of the order include, ***a*** biting mouth parts; ***b*** leathery forewings; ***c*** the eggs are laid in oothecae. The members exhibit many features of primitive insects. ↑ EXOPTERYGOTA[2]

CC087 Odonata (*n.pl.*) An order of Exopterygota; its members include dragonflies. Characteristics of the order are, ***a*** large eyes; ***b*** two pairs of similar wings; ***c*** aquatic nymphs. The members are all carnivorous, both adults and larvae. There are two main sub-orders; Anisoptera, which contains the true dragonflies, and Zygoptera, which contains the more slender damsel flies, which have weaker flight. ↑ EXOPTERYGOTA[2]

CC088 Orthoptera (*n.pl.*) An order of Exopterygota; its members include the crickets, locusts and grasshoppers. Characteristics of members are, ***a*** narrow hardened forewings; ***b*** membranous hind-wings; ***c*** hind-legs modified for jumping; ***d*** they produce sounds by stridulation. The majority of the members are terrestrial insects with biting mouth parts; some members are flightless. —***orthopteran*** (*n.*) ***orthopterous*** (*adj.*) ↑ EXOPTERYGOTA[2] → STRIDULATION

CC089 Isoptera (*n.pl.*) An order of Exopterygota; it contains the termites, social insects in highly organized communities, with an elaborate system of castes. The main food of the termites is cellulose, and they are pests of timber; their nests are mainly underground, but they also form great ant-hills above ground. —***isopteran*** (*n.*) ***isopteran*** (*adj.*) ↑ EXOPTERYGOTA[2]

CC090 Hemiptera (*n.pl.*) A large order of Exopterygota; its members, the bugs, include green-flies (*Aphis*), leaf-hoppers, bed-bugs, scale-insects, and cochineal-insects. Characteristics of the order are, ***a*** two pairs of wings in the majority of species; ***b*** the winged species have the anterior pair of wings hardened, although the tip remains membranous, ***c*** the mouth parts are adapted for piercing and sucking plant juices and blood. The order is of great economic importance, since many members are pests. —***hemipteran*** (*n.*) ***hemipteran, hemipterous*** (*adj.*) ↑ EXOPTERYGOTA[2]

CC091 Ephemeroptera (*n.pl.*) An order of Exopterygota; it includes the mayflies. Characteristics are, ***a*** aquatic nymphs which may moult many times and live up to 2–3 years; ***b*** the nymph develops into a flying sub-imago stage; ***c*** adults have a large thin pair of wings and a small pair of wings; ***d*** adults have no functional mouth, do not eat or drink, and live for periods ranging from a few minutes to twenty-four hours. ↑ EXOPTERYGOTA[2]

CC092 Arachnida (*n.pl.*) A class of Arthropoda; its members include spiders, scorpions, ticks, mites, and king-crabs; king-crabs are aquatic, but the remainder are terrestrial. The characteristics of the class are, ***a*** no antennae; ***b*** the first pair of appendages are chelicerae used for gripping; ***c*** the second pair (pedipalps) may be sensory, locomotory, or used for gripping; ***d*** the remaining four pairs of appendages are locomotory; ***e*** the body is divided into two parts, prosoma and opisthosoma; ***f*** simple eyes; ***g*** respiration is often by lung books or gill books. Some classifications regard the king-crabs as a separate class (Merostomata). —***arachnid*** (*n.*) ***arachnid*** (*adj.*) ↓ SCORPIONIDEA · KING-CRAB ↑ ARTHROPODA · ANIMAL KINGDOM → PEDIPALP · LUNG BOOK · GILL BOOK · CHELICERA

CC093 Scorpionidea (*n.pl.*) An order of Arachnida, containing the scorpions. Characteristics of the order are, ***a*** a pair of large pincers at the anterior end (modified pedipalps); ***b*** four pairs of legs attached to the cephalothorax; ***c*** a number of simple eyes, almost useless; ***d*** a clearly segmented abdomen ending in a narrow tail with a sting, ***e*** a poisonous sting used in defence but not for capturing food; ***f*** food is torn by small chelicerae and juices sucked through a narrow mouth; ***g*** breathing is by lungs. - ***scorpioid*** (*adj.*) ↓ XIPHOSURA · ACARINA · ACARI · ARANEIDA · ARANEAE · SCORPIONES ↑ ARACHNIDA

CC094 Xiphosura (*n.pl.*) An order of Arachnida; its sole member is the king-crab, genus *Limulus*. The king-crabs are aquatic arachnids, of much greater size than all other arthropods; they possess a semi-circular carapace, and a long, stiff, tail. The king-crabs live on the sea-bed near the shore, and burrow in the sand for food. They are of scientific interest as they have persisted unchanged in form or function for millions of years; other members of the order are now extinct. ↑ SCORPIONIDEA

CC095 Acarina (*n.pl.*) An order of the class Arachnida, its members include the ticks and mites. Characteristics are, ***a*** there is little segmentation of the body; ***b*** no clear distinction between cephalothorax and abdomen; ***c*** the body is short and often round in shape. The members are fre-

quently parasitic, and are important as vectors of disease for animals and plants. ↑ SCORPIONIDEA

CC096 Acari (*n.pl.*) Alternative term for ACARINA. ↑ SCORPIONIDEA

CC097 Araneida (*n.pl.*) An order of Arachnida; its members include the spiders. Characteristics of the order are, ***a*** the front prosoma is joined by a narrow waist to the soft opisthosoma; ***b*** silk is produced in spinnerets for trapping or wrapping prey, building egg cocoons, etc.; ***c*** its members are carnivorous. ↑ SCORPIONIDEA → SPINNERET

CC098 Araneae (*n.pl.*) Alternative term for ARANEIDA. ↑ SCORPIONIDEA

CC099 Scorpiones (*n.pl.*) Alternative term for SCORPIONIDEA.

CC100 king-crab (*n.*) A member of the Xiphosura. ↓ HORSESHOE CRAB ↑ ARACHNIDA · XIPHOSURA

CC101 horseshoe crab (*n.*) Alternative term for KING-CRAB.

CC102 Mollusca (*n.pl.*) A large phylum of invertebrate animals with soft bodies, usually covered with a calcareous shell. Characteristics of the phylum are, ***a*** an unsegmented body; ***b*** a well-developed head; ***c*** a muscular foot; ***d*** a mantle and a mantle cavity in which gills are situated; ***e*** a reduced coelom and a haemocoel; ***f*** radula as a typical feeding organ. The most important classes are Gastropoda, Cephalopoda and Lamellibranchiata. The members of the phylum include mussels, snails, octopuses, etc., and they are mainly aquatic. —***mollusc*** (*n.*) ↓ GASTROPODA · CEPHALOPODA · LAMELLIBRANCHIATA · SCAPHOPODA ↑ ANIMAL KINGDOM → RADULA

CC103 Gastropoda (*n.pl.*) A class of Mollusca with marine, freshwater, and terrestrial members. Its members possess a distinct head with tentacles and eyes, and a flat muscular foot; they often possess a univalve (single) shell. Marine members include limpets, periwinkles, whelks and sea-slugs. Freshwater and terrestrial members include slugs and snails. —***gastropod*** (*n.*) ***gastropod*** (*adj.*) ↓ UNIVALVIA · PULMONATA · PTERAPODA ↑ MOLLUSCA

CC104 Univalvia (*n.pl.*) Alternative term for GASTROPODA. —UNIVALVE (*n.,adj.*)

CC105 Pulmonata (*n.pl.*) An order of the class Gastropoda; its members have a mantle cavity which has become modified to form a pulmonary sac for breathing air, *e.g.* the snails and slugs. —***pulmonata*** (*adj.*) ↑ GASTROPODA

CC106 Pterapoda (*n.pl.*) A group of a few families of the class Gastropoda, distinguished by the development of the front part of the foot into two large thin wings, used for swimming; a shell may or may not be present. The class is adapted for pelagic life. —***pteropod*** (*n.*) ***pteropod*** (*adj.*) ↑ GASTROPODA

CC107 Cephalopoda (*n.pl.*) A class of the phylum Mollusca; its members include squids, octopuses and cuttle fish, all marine animals. Characteristics of the class are, ***a*** a well-defined head; ***b*** powerful eyes; ***c*** a well-developed nervous system; ***e*** no shell covering the body, but a reduced shell found inside the mantle; ***f*** locomotion is by squirting water through a siphon; ***g*** some species squirt ink through their siphon in times of danger. The class also includes the nautilus. —***cephalopod*** (*n.*) ***cephalopod*** (*adj.*) ↓ DIBRANCHIATA · OCTOPODA · DECAPODA[2] ↑ MOLLUSCA

CC108 Dibranchiata (*n.pl.*) An order of Cephalopoda; its members have 8 or 10 tentacles and a single pair of gills. The order is split into two sub-orders, Octopoda and Decapoda. ↑ CEPHALOPODA

CC109 Octopoda (*n.pl.*) A sub-order of Dibranchiata; its members include the octopus. Characteristics are, ***a*** having eight tentacles; ***b*** lines of suckers on the tentacles. The members are generally marine and live in cracks between stones or rocks; they can swim by use of a siphon-tube when necessary. ↑ CEPHALOPODA

CC110 Decapoda[2] (*n.pl.*) A sub-order of Dibranchiata; its members include the squids. Characteristics are, ***a*** having ten tentacles; ***b*** having two tentacles longer than the others, and retractable; ***c*** having pedunculate suckers on the tentacles. —***decapod*** (*n.,adj.*) ↑ CEPHALOPODA

CC111 Lamellibranchiata (*n.pl.*) A class of Mollusca; it contains mussels, clams, oysters, and all members are aquatic. The class is characterized by lamellae (plate-like gills) which extend almost the length of the bivalve shell of the animal; the gills possess cilia and these set up elaborate ciliary currents of water; food particles are swept from the gills onto labial palps and then into the mouth; the gills also carry out the normal respiratory function. The shell is hinged dorsally and the body is laterally compressed. —***lamellibranch*** (*n.*) ***lamellibranchiate, lamellibranch*** (*adj.*) ↓ LAMELLIBRANCHIA · BIVALVIA ↑ MOLLUSCA

CC112 Lamellibranchia (*n.pl.*) Alternative term for LAMELLIBRANCHIATA.

CC113 Bivalvia (*n.pl.*) Common alternative term for LAMELLIBRANCHIATA. —***bivalve*** (*adj.*)

CC114 Scaphopoda (*n.pl.*) A small class of Mollusca; its members are all marine, and burrow in the sand. The members possess tubular shells open at both ends and a pointed foot specialized for burrowing. —***scaphopod*** (*n.,adj.*) ↑ MOLLUSCA

CC115 Brachiopoda (*n.pl.*) A phylum of marine animals, whose members have shown little evolution over millions of years. Characteristics of the phylum are, ***a*** they possess a shell, usually two-valved, which may or may not be hinged; the shell valves are dorsal and ventral, as opposed to the lateral shell valves in bivalves; ***b*** they possess a lophophore and a pair of long, coiled, ciliated arms for producing a current of water to sweep food particles into the mouth. The members superficially resemble mussels, but are not closely related to them;

they are called lamp shells. —***brachiopod*** (*n., adj.*) ↑ ANIMAL KINGDOM

CC116 Echinodermata (*n.pl.*) A large phylum of marine animals; it contains sea-urchins, sea-cucumbers, starfishes, brittle-stars and feather-stars. Characteristics of the phylum are, ***a*** its members are radially symmetrical, usually with five axes of symmetry; ***b*** they possess tube feet; ***c*** a water-vascular system; ***d*** a true coelom; ***e*** no structure recognizable as a head; ***f*** no brain and poor sense organs; ***g*** calcareous skeletal plates, sometimes with spines. The mode of development of the members provides evidence that they and vertebrates have common origins; they have few similarities with other invertebrates. —***echinoderm*** (*n.*) ***echinoderm*** (*adj.*) ↓ OPHIUROIDEA ↑ ANIMAL KINGDOM → TUBE FOOT · WATER VASCULAR SYSTEM

CC117 Ophiuroidea (*n.pl.*) A class of Echinodermata; its members are brittle stars. Characteristics of the class are, ***a*** a star-shaped body with a small central disc; ***b*** long and sinuous arms; ***c*** its members readily exhibit autotomy. —***ophiuroid*** (*n.,adj.*) ↓ HOLOTHUROIDEA ↑ ECHINODERMATA → AUTOTOMY

CC118 Holothuroidea (*n.pl.*) A class of Echinodermata; it contains the sea-cucumbers. The members have soft cylindrical bodies and are without arms but have tentacles around the mouth to assist in food capture. The skeleton is reduced. —***holothuroid*** (*n.*) ***holothuroid*** (*adj.*) ↑ OPHIUROIDEA

CC119 Chordata (*n.pl.*) A large phylum of animals; it includes the sub-phyla Cephalochordata, Hemichordata, Urochordata and Vertebrata. The phylum is characterized by the possession of, ***a*** a notochord; ***b*** gill-slits at some time in the animal's life; ***c*** a dorsal tubular nerve cord lying above the notochord. —***chordate*** (*n.*) ***chordate*** (*adj.*) ↓ PROTOCHORDATA · HEMICHORDATA · UROCHORDATA · VERTEBRATA · TETRAPODA · HEMICHORDATE · PISCES · AMPHIBIA · REPTILIA · AVES · MAMMALIA · PLACENTALIA ↑ ANIMAL KINGDOM

CC120 Protochordata (*n.pl.*) A term used to describe all members of the phylum Chordata except the vertebrates, *i.e.* a heterogeneous collection of animals. The characteristics they possess in common are, ***a*** a notochord; ***b*** gill-slits; ***c*** a hollow dorsal nerve cord; these characteristics may be only partially developed. All protochordates are marine. The classification includes the Cephalochordata, the Hemichordata, and the Urochordata. The Protochordata and the Vertebrata together constitute the phylum Chordata. —***protochordate*** (*n.,adj.*) ↓ PROCHORDATA · CHOANATA ↑ CHORDATA

CC121 Prochordata (*n.pl.*) Alternative term for PROTOCHORDATA.

CC122 Choanata (*n.pl.*) A group of vertebrate classes characterized by, ***a*** having internal nares opening into the mouth; ***b*** an axial skeleton with paired limbs or their homologues. The group includes Choanichthyes, Amphibia, Reptilia, Aves, and Mammalia. The term is not a taxon. —***choanate*** (*adj.*) ↑ PROTOCHORDATA

CC123 Hemichordata (*n.pl.*) A small sub-phylum of Chordata; it contains small, worm-like, burrowing animals. The connection with Chordata is remote, but the members do possess a notochord (in the anterior region only), gill-slits and a dorsal nerve cord, hollow in the anterior region. The development of the embryo suggests a relationship with Echinodermata. All members are marine. Some classifications do now regard these animals as chordates. —***hemichordate*** (*n.,adj.*) ↓ CEPHALOCHORDATA · ACRANIA · AMPHIOXUS ↑ CHORDATA

CC124 Cephalochordata (*n.pl.*) A sub-phylum of Chordata; its members are all small, worm-like, aquatic animals living in sand. Characteristics are, ***a*** they possess no brain; ***b*** they possess no bony skeleton. Amphioxus is a member of Cephalochordata. ↑ HEMICHORDATA

CC125 Acrania (*n.pl.*) Alternative term for CEPHALOCHORDATA. ↑ HEMICHORDATA

CC126 amphioxus (*n.*) A small, primitive chordate animal, a cephalochordate, about 5 cm long, found in the sand of the sea-bed of shallow seas in different parts of the world. It has a notochord extending the length of its body; the notochord persists throughout life. It has no cartilaginous or bony skeleton or skull, and has no brain. ↑ HEMICHORDATA

CC127 Urochordata (*n.pl.*) A sub-phylum of Chordata; in some classifications a class of Acrania; its members include the sea squirts. An adult sea squirt is sedentary and soft-bodied; it possesses gill-slits in its pharynx, and a reduced nervous system, but no notochord; it feeds by ciliary currents drawing food and water into its mouth. Eggs of the Urochordata develop into tadpole-like larvae, active and free-swimming. A larva possesses a well-developed nervous system, a notochord, and a pharynx with one or more pairs of gill-slits. These features of the larva indicate it is a chordate. —***urochordate*** (*n.,adj.*) ↓ UROCHORDA · TUNICATA ↑ CHORDATA

CC128 Urochorda (*n.pl.*) Alternative term for UROCHORDATA.

CC129 Tunicata (*n.pl.*) Alternative term for UROCHORDATA. —***tunicate*** (*n.,adj.*)

CC130 Vertebrata (*n.pl.*) A sub-phylum of Chordata; it contains the fishes, amphibians, reptiles, birds, and mammals. Characterized by, ***a*** a bony or cartilaginous skull surrounding a well-developed brain; ***b*** an endoskeleton of cartilage or bone; ***c*** (in most members) the notochord is replaced by a vertebral column of cartilage or bone. —VERTEBRATE (*n.*) VERTEBRATE (*adj.*) ↓ CRANIATA · AGNATHA · GNATHOSTOMATA · CYCLOSTOMATA ↑ CHORDATA

CC131 Craniata (*n.pl.*) Another term for Vertebrata; it is more precise as all members of the sub-phylum possess a bony skull,

whereas not all possess a true vertebral column. The term is rarer in use than Vertebrata. —***craniate*** (*adj.*) ↑ VERTEBRATA

CC132 Agnatha (*n.pl.*) A class of Vertebrata, sometimes considered to be a superclass; its members are primitive aquatic, eel-like vertebrates without jaws and without paired fins. The order Cyclostomata contains the only living forms. —***agnathan*** (*n.,adj.*) ↑ VERTEBRATA

CC133 Gnathostomata (*n.pl.*) A group comprising classes of vertebrates with jaws, as opposed to the class Agnatha. In this grouping Agnatha and Gnathostomata both become super-classes of sub-phyla. —***gnathostome*** (*n.,adj.*) ↑ VERTEBRATA

CC134 Cyclostomata (*n.pl.*) An order of the class Agnatha; its members are the lampreys and hagfishes, the only living agnathans. Characteristics of the order are, ***a*** snake-like, aquatic animals; ***b*** they have no scales on the body; ***c*** no legs or jaws; ***d*** no paired fins. They have a round mouth with which they attach themselves to fish, whose flesh they rasp with a horny tongue, and suck blood. Some lampreys live in fresh water, but all other members of the order, living or extinct, are marine. —***cyclostome*** (*n.*) ↑ VERTEBRATA

CC135 Tetrapoda (*n.pl.*) A group which includes all vertebrates with limbs as opposed to fins, *i.e.* the terrestrial vertebrates such as amphibians, some reptiles, birds and mammals. It is a natural grouping and not a taxon. —TETRAPOD (*n.*) ***tetrapod*** (*adj.*) ↓ AMNIOTA · ANAMNIOTA · AMNIOTE · ANAMNIOTE ↑ CHORDATA

CC136 Amniota (*n.pl.*) A group of vertebrate classes consisting of reptiles, birds, and mammals. All are essentially terrestrial animals whose embryos have an amnion and an allantois. The term is not a taxon; it describes a useful natural group. ↑ TETRAPODA → AMNION · ALLANTOIS

CC137 Anamniota (*n.pl.*) A group of vertebrate classes consisting of Agnatha, fishes and amphibians. Their embryos do not have an amnion; their eggs need water for development and are not cleidoic. The term is not a taxon; it describes a useful natural group. ↑ TETRAPODA

CC138 amniote (*n.*) An animal belonging to the group of Amniota ↑ TETRAPODA

CC139 anamniote (*n.*) An animal belonging to the group of Anamniota. ↑ TETRAPODA

CC140 hemichordate (*adj.*) Possessing a poorly-developed notochord. ↑ CHORDATA

CC141 Pisces (*n.pl.*) Formerly a class of the sub-phylum Vertebrata; it included all the fishes; the class was divided into four subclasses. The taxon is no longer used; the sub-classes are now regarded as four classes of the sub-phylum Vertebrata; they are Placodermi, Chondrichthyes, Actinopterygii, and Choanichthyes. In some classifications Actinopterygii and Choanichthyes are regarded as sub-classes of the class Osteichthyes. —***pisciform*** (*adj.*) ↓ PLACODERMI · OSTEICHTHYES · TELEOSTOMI ↑ CHORDATA

CC142 Placodermi (*n.pl.*) A class of extinct fishes. Its members had a full-sized first gill-slit or spiracle (in living species the spiracle is closed) and a primitive form of upper jaw attached directly to the neurocranium. —***placoderm*** (*n.,adj.*) ↓ CHONDRICHTHYES · ELASMOBRANCHII · HOLOCEPHALI ↑ PISCES

CC143 Chondrichthyes (*n.pl.*) Usually regarded as a class which is split into two sub-classes, Elasmobranchii and Holocephali. In some classifications, Chondrichthyes is an alternative term for Elasmobranchii. The class contains the cartilaginous fishes. ↑ PLACODERMI

CC144 Elasmobranchii (*n.pl.*) The members of Elasmobranchii are fishes with cartilaginous skeletons, possessing no trace of bone; their characteristics are, ***a*** rough skin covered with placoid scales; ***b*** a heterocercal tail; ***c*** gill-slits not covered with an operculum. The class of Elasmobranchii contains the sharks and rays. —***elasmobranch*** (*n.,adj.*) ↑ PLACODERMI

CC145 Holocephali (*n.pl.*) A sub-class of Chondrichthyes. Most of its members are now extinct; living members include *Chimaera*. Characteristics of the class are, ***a*** they possess large, flat, crushing teeth for a diet of molluscs; ***b*** the upper jaw is fused to the skull; ***c*** there is an operculum covering the gill-slits; ***d*** a lack of placoid scales and a spiracle. ↑ PLACODERMI

CC146 Osteichthyes (*n.pl.*) A class of Vertebrata comprising the bony fishes, divided into two sub-classes Actinopterygii and Choanichthyes; in some classifications these sub-classes are treated as classes. Characteristics include possession of an operculum and a bony skeleton. ↓ ACTINOPTERYGII · CHOANICHTHYES · CROSSOPTERYGII · DIPNOI ↑ PISCES

CC147 Actinopterygii (*n.pl.*) A sub-class of Osteichthyes; its members include the majority of living bony fishes. Characteristics of the class are, ***a*** a true bony skeleton; ***b*** no skeletal axis in paired fins, skeletal support being provided by parallel horny rays; ***c*** the nares do not connect the mouth to the exterior; ***d*** the primitive species possess ganoid scales; ***e*** they possess hyostylic jaw suspension. —***actinopterygian*** (*adj.*) ↑ OSTEICHTHYES

CC148 Choanichthyes (*n.pl.*) A sub-class of Osteichthyes, sometimes regarded as a separate class; it is split into the orders Crossopterygii and Dipnoi. Characteristics of the sub-class are, ***a*** nares with an external opening on the face and an internal opening to mouth; ***b*** paired fins with a central skeletal axis; ***c*** cosmoid scales. ↑ OSTEICHTHYES

CC149 Crossopterygii (*n.pl.*) A sub-class or order of Choanichthyes; its members include the coelacanth (*Latimeria*) and many fossil fishes. The members are bony fishes, differing from Dipnoi in having normal, *i.e.* conical teeth. The possession of

internal nares, with the possibility of breathing air suggests with some certainty that terrestrial vertebrates evolved from this group of fishes. —***crossopterygian*** (*n.*) ***crossopterygian*** (*adj.*) ↑ OSTEICHTHYES

CC150 Dipnoi (*n.pl.*) A sub-class or order of Choanichthyes; its members include the lung-fish, and all are freshwater animals found in tropical areas only. Dipnoi differ from Crossopterygii in having a special tooth plate used to crack small molluscs, their staple diet. The members have functional lungs and survive drought by burying themselves in the mud. —***dipnoan*** (*n.*) ***dipnoan*** (*adj.*) ↑ OSTEICHTHYES

CC151 Teleostomi (*n.pl.*) A group of fishes comprising Actinopterygii and Crossopterygii but excluding Dipnoi, *i.e.* the bony fishes excluding the lung-fish. The taxon is now obsolete. ↓ TELEOSTEI · LATIMERIA ↑ PISCES

CC152 Teleostei (*n.pl.*) A group of bony fishes, its members including most of the bony fishes living in the world today (about 20 000 species). Its members are characterized by having an ossified skeleton and either cycloid or ctenoid scales, replacing ganoid scales. Primitive teleosts retain the connection between the swim-bladder and the gut, but the more advanced teleosts have lost the connection. There is a wide range in shape of teleosts from sea-horses to salmon, and from flat-fish to eels. The group is variously considered, in different systems of classification, to be, ***a*** a sub-class of Pisces; ***b*** an order of Actinopterygii; ***c*** a sub-class of Actinopterygii; ***d*** a natural group, rather than a taxon. The adaptation of the swim bladder as a hydrostatic organ has been the chief reason for the success of the group. ↑ TELEOSTOMI

CC153 *Latimeria* (*n.pl.*) The only living member of Crossopterygii: a marine fish found near South Africa. ↑ TELEOSTOMI · CROSSOPTERYGII

CC154 Amphibia (*n.pl.*) A class of Vertebrata; its members are tetrapods with pentadactyl limbs and include the frogs, toads, and salamanders. Characteristics of the class are, ***a*** its members are oviparous; ***b*** they undergo a larval stage in water; ***c*** the adults are terrestrial, ***d*** they undergo metamorphosis. The Amphibia have evolved from crossopterygian fish —AMPHIBIAN (*n.*) AMPHIBIOUS (*adj.*) ↓ ANURA ↑ CHORDATA

CC155 Anura (*n.pl.*) An order of Amphibia; its members include the frogs and toads. Frogs generally have longer legs than toads, and they hop, while toads walk. Characteristics of the order are, ***a*** its members do not have tails; ***b*** they have long hind legs; ***c*** soft skin is used in respiration; ***d*** there are no scales on the skin. —***anuran*** (*n.,adj.*) ↓ URODELA · APODA ↑ AMPHIBIA

CC156 Urodela (*n.pl.*) An order of Amphibia; its members include the newts and salamandars. It is distinguished from the other two orders by its members possessing four limbs, a tail, and an elongated body. They are the least specialized of the amphibians, and are more aquatic. Neoteny is a feature of the order. —***urodelan*** (*n.*) ***urodelan*** (*adj.*) ↑ ANURA

CC157 Apoda (*n.pl.*) An order of Amphibia; its members are tropical worm-like animals, which burrow in earth or sand on the shore, and live on a diet of earthworms or marine worms. The members of Apoda are the only amphibians to possess scales, although not all possess scales; the scales are buried deeply in the skin. —***apodan*** (*n.,adj.*) ↑ ANURA

CC158 Reptilia (*n.pl.*) A class of the sub-phylum Vertebrata; its members are air-breathing terrestrial animals that evolved many millions of years ago from the class Amphibia. The class is now represented by only four orders (Squamata, Chelonia, Rhynchocephalia, and Crocodilia), but in Mesozoic times the reptiles were the dominant form of life and included the dinosaurs. Characteristics of Reptilia are, ***a*** they are tetrapods (some with much reduced legs); ***b*** they possess a horny skin of scales or plates; ***c*** their embryos are enclosed in an egg-shell and have a protective amnion and an allantois; ***d*** their eggs are cleidoic; ***e*** they are poikilothermic (cold-blooded); ***f*** they possess metanephric kidneys. —***reptile*** (*n.*) ***reptilian*** (*adj.*) ↓ SQUAMATA · DIAPSIDA · SAURIAN · SYNAPSID ↑ CHORDATA

CC159 Squamata (*n.pl.*) An order of Reptilia; its members are the snakes and lizards, characterized by a body covered with horny epidermal scales. ↓ OPHIDIA · SAURIA · LACERTILIA · CHELONIA · RHYNCHOCEPHALIA · CROCODILIA ↑ REPTILIA

CC160 Ophidia (*n.pl.*) A sub-order of Squamata, but sometimes made a separate order of Reptilia; its members are the snakes. Characteristics are, ***a*** they are limbless animals; ***b*** they have an exceptionally wide gape, arising from their jaw structure; ***c*** they have immovable eyelids with nictitating membrane fused over the cornea; ***d*** they have eardrums and are able to detect vibrations, but not sounds. —***ophidian*** (*n.*) ***ophidian*** (*adj.*) ↑ SQUAMATA

CC161 Sauria (*n.pl.*) A sub-order of Squamata; in some classifications it is a separate order of Reptilia; its members include the lizards. Characteristics of the group are, ***a*** they have a normal-size gape; ***b*** they have movable eyelids; ***c*** they possess eardrums. Most members are tetrapods. ↑ SQUAMATA

CC162 Lacertilia (*n.pl.*) Alternative term for SAURIA.

CC163 Chelonia (*n.pl.*) An order of Reptilia; its members include the tortoises and turtles. Characteristics of the order are, ***a*** a body encased in plates of bone covered with horn of epidermal origin; ***b*** a horny beak with no teeth; ***c*** pectoral and pelvic girdles inside the ribs; ***d*** the head, tail and legs can be withdrawn into the bony case.

—***chelonian*** (*n.*) ***chelonian*** (*adj.*) ↑ SQUAMATA

CC164 Rhynchocephalia (*n.pl.*) A small order of Reptilia; its members are similar to lizards. Only one living form exists, *Sphenodon* (found in New Zealand); all other members are extinct. ↑ SQUAMATA · REPTILIA

CC165 Crocodilia (*n.pl.*) An order of the class Reptilia containing the crocodiles and the alligators. The chief characteristic is the presence of a long bony false palate, with the internal openings of the nares placed far back in the mouth. —***crocodile*** (*n.*) ↑ SQUAMATA

CC166 Diapsida (*n.pl.*) A natural group of Reptilia, it contains all the reptiles except turtles and tortoises. The characteristic of the group is two openings in the side of the skull. ↓ SAUROPSIDA · THEOPSIDA[1] · THERAPSIDA · THEROPSIDA ↑ REPTILIA

CC167 Sauropsida (*n.pl.*) (Used to denote a natural group, but not a taxon) all reptiles, both living and fossil forms, and all birds; all of these animals are closely related, and the group is comparable with Theropsida and Theopsida. ↑ DIAPSIDA ↓ THEROPSIDA

CC168 Therapsida (*n.pl.*) An extinct order of Reptilia; its members were the ancestors of the earliest mammals, the transition from reptile to mammal having much evidence from fossil remains. ↑ DIAPSIDA

CC169 Theopsida[1] (*n.pl.*) Alternative term for THERAPSIDA. ↑ DIAPSIDA

CC170 Theropsida (*n.pl.*) (Used to denote a natural group but not a taxon) all the mammals ↑ DIAPSIDA

CC171 saurian (*adj.*) Resembling a lizard in appearance. ↑ REPTILIA

CC172 synapsid (*adj.*) Describes a skull in which there is a single fossa, or hollow, at the side of the skull. The muscles for lifting the lower jaw bone are inserted in the hollow. ↓ DIAPSID · ANAPSID ↑ REPTILIA

CC173 diapsid (*adj.*) Describes a skull in which there is a division between the two fossae, or hollows, at the sides of the skull. ↑ SYNAPSID

CC174 anapsid (*adj.*) Describes a skull which is completely roofed over without fossae, or hollows, at the sides of the skull. ↑ SYNAPSID

CC175 Aves (*n.pl.*) A class of vertebrates; its members are all the birds. Characteristics of the class are, ***a*** a body covered with feathers; ***b*** front-limbs modified to form wings; ***c*** they possess horny beaks and no teeth; ***d*** having the lower part of the hind-limbs covered in scales; ***e*** they are oviparous animals; ***f*** they are homiothermic (warm-blooded). Characteristics ***d*** and ***e*** reveal their affinities with reptiles. Characteristics ***a, b*** and ***c*** are adaptations to flight; other adaptations to flight include a four chambered heart, pneumatic bones and a keeled sternum. The class is divided into two sub-classes, Archaeornithes and Neornithes. All members of Archaeornithes are extinct, they included the earliest fossil birds with teeth, claws, three-fingered hands, long tail with many vertebrae; they thus resembled reptiles with feathers. —***avian*** (*adj.*) ↓ NEORNITHES · RATITES · PASSERINE ↑ CHORDATA

CC176 Neornithes (*n.pl.*) A sub-class of Aves; its members include all the living birds and many extinct forms. The sub-class is divided into four super-orders: Odontognathae (all members extinct); Palaeognathae; Impennae; and Neognathae. The members of Palaeognathae are the flightless birds, such as the ostriches and kiwis; the members of Impennae are the penguins. Neognathae contains many orders and includes all the flying birds. Each order ends in **-formes**. ↓ PASSERIFORMES ↑ AVES

CC177 Passeriformes (*n.pl.*) The largest order of birds; it includes more than half the known species. Its members are perching birds with the hallux (big toe) pointing backwards, and the other three toes pointing forwards. —***passerine*** (*n.,adj.*) ↑ NEORNITHES

CC178 ratites (*n.pl.*) A term sometimes used in classification, but not a taxon, to include all living, flightless birds, *e.g.* ostriches, kiwis, emus. A ratite is characterized by, ***a*** having no keel on the sternum; ***b*** no barbules on its feathers; ***c*** wings much reduced in size; ***d*** typically long powerful hind legs for running. The ratites are not closely related to each other, having arisen by convergence. ↓ CARINATES (An) ↑ AVES → CONVERGENCE

CC179 carinates (*n.pl.*) A term used in contrast to ratites to describe birds which fly; such birds possess, ***a*** a keel on the sternum; ***b*** barbules on the feathers; ***c*** well-developed wings capable of flight. ↑ RATITES

CC180 passerine (*adj.*) Of or to do with the order of Passeriformes, *e.g.* a passerine bird is a perching bird. ↑ AVES

CC181 Mammalia (*n.pl.*) A large class of the sub-phylum Vertebrata. All members of the class are tetrapod vertebrates, although some have reduced limbs. Characteristics of the class are, ***a*** they suckle young on milk produced by the mother's mammary glands; ***b*** they possess hair; ***c*** they maintain a constant temperature (homiothermic); ***d*** the diaphragm is used in respiration; ***e*** only the left systemic arch of the aorta is present; ***f*** three auditory ossicles in the middle ear; ***g*** the lower jaw formed from a single bone. The class is divided into three sub-classes: Prototheria, Metatheria, and Placentalia (or Eutheria). —***mammal*** (*n*) ***mammalian*** (*adj.*) ↓ PROTOTHERIA · THEOPSIDA[2] · MAMMAL · MARSUPIAL ↑ CHORDATA → PLACENTALIA

CC182 Prototheria (*n.pl.*) A sub-class of Mammalia containing the duck-billed platypus and other mammals exhibiting primitive features. It is alternatively regarded as an order and synonymous with Monotremata. As a sub-class it contains only the order Monotremata. ↓ METATHERIA · EUTHERIA · THERIA · MONOTREMATA · MARSUPALIA ↑ MAMMALIA

CC183 Metatheria (*n.pl.*) A sub-class of Mammalia containing the marsupials, alternatively regarded as an order and synonymous with Marsupalia. As a sub-class it contains only the order Marsupalia. ↑ PROTOTHERIA

CC184 Eutheria (*n.pl.*) An alternative term for PLACENTALIA. It is a sub-class of Mammalia which includes most of the mammals and contains numerous orders. —***eutherian*** (*n., adj.*) ↑ PROTOTHERIA

CC185 Theria (*n.pl.*) In some classifications the sub-classes, Metatheria and Eutheria are grouped in the infra-class Theria. ↑ PROTOTHERIA

CC186 Monotremata (*n.pl.*) A sub-class or order of Mammalia; it includes the duck-billed platypus and the spiny anteaters. It is a group of mammals exhibiting primitive features indicating the reptilian ancestors of mammals. The mammalian characteristics of the group are, ***a*** they possess hair; ***b*** they secrete milk from specialized sweat glands which open as slits on the abdomen; ***c*** they suckle their young. The reptilian characteristics are, ***a*** they lay shelled, yolky eggs; ***b*** they possess a cloaca; ***c*** they possess bones in the skull, limbs, and limb girdles which are like those of reptiles. The spiny anteaters grow a marsupium (pouch) during the breeding season. —***monotreme*** (*n., adj.*) ↑ PROTOTHERIA

CC187 Marsupalia (*n.pl.*) A sub-class of Mammalia; in some systems of classification, the sub-class is called Metatheria, and Marsupalia becomes an order of the sub-class. The members of the sub-class are limited in habitat mainly to Australia and South America, with a few in the southern part of North America, *e.g.* the kangaroo and wombat in Australia, the opossum in America. Characteristics of marsupials are, ***a*** the embryo is connected to a yolk sac, instead of to an allantois (as in placental mammals); ***b*** very immature young are born at an early stage in development, only about 2 cm long; ***c*** the young find their own way to a marsupium, and the embryo is usually suckled on teats; this stage lasts several weeks; all offspring of the litter are kept in the marsupium. —***marsupial*** (*n., adj.*) ↑ PROTOTHERIA

CC188 Theopsida[2] (*n.pl.*) A natural group of all the true mammals; not a taxon. ↓ UNGULATE · PROBOSCIDEA[2] ↑ MAMMALIA → SAUROPSIDA

CC189 ungulate (*n.*) A term describing mammals with hooves; now obsolete in classification, but useful as a natural grouping. Ungulates are herbivorous and adapted for running on hard, open ground; they generally live in herds. ↑ THEOPSIDA[2] → PERISSODACTYLA · ARTIODACTYLA

CC190 Proboscidea[2] (*n.pl.*) Elephants. Mammals of a large size, with a proboscis (trunk), long protruding incisors (tusks), and large grinding molars. The proboscis is a very long tube-like nose, with flaps at the opening, which are used to grip objects and to close the trunk. The proboscis is also used to put food in the mouth, to suck up water and then expel it. ↑ THEOPSIDA[2]

CC191 mammal (*n.*) A tetrapod vertebrate with the characteristics of: hair, milk secretion, the diaphragm used in respiration, the left systemic arch only in the systemic circulatory system, the three auditory ossicles in each middle ear. A member of the class Mammalia, *e.g.* the monkey, the cat, the elephant. ↑ MAMMALIA

CC192 marsupial (*adj.*) Of or to do with a member of the Marsupalia or a marsupium. ↓ MAMMALIAN ↑ MAMMALIA

CC193 mammalian (*adj.*) Of or to do with mammals. ↑ MARSUPIAL (H)

CC194 Placentalia (*n.pl.*) A sub-class of Mammalia; it includes most of the mammals. Characteristics of the group are, ***a*** the embryo develops fully in the uterus; ***b*** the embryo is attached to the uterus by a placenta; ***c*** the cerebral cortex is larger and more complex than in other mammals. —PLACENTAL (*adj.*) ↓ EDENTATA · RODENTIA · ARTIODACTYLA · CARNIVORA · PRIMATES ↑ CHORDATA · MAMMALIA

CC195 Edentata (*n.pl.*) An order of Placentalia; its members include the sloths, armadillos, and great anteaters. The main characteristic of the order is much reduced teeth or no teeth. —***edentate*** (*n.*) EDENTATE (*adj.*) ↓ PHOLIDOTA · TUBULIDENTATA · INSECTIVORA ↑ PLACENTALIA

CC196 Pholidota (*n.pl.*) An order of the sub-class Placentalia; its members include the scaly anteater. ↑ EDENTATA

CC197 Tubulidentata (*n.pl.*) An order of the sub-class Placentalia; its members include the aardvark. ↑ EDENTATA

CC198 Insectivora (*n.pl.*) An order of Placentalia; it contains the moles, hedgehogs and shrews. A primitive group of vertebrates, they eat insects and other small animals. They possess many small unspecialized teeth, and resemble the ancestors of all placental mammals. —***insectivore*** (*n.*) ↑ EDENTATA

CC199 Rodentia (*n.*) An order of the sub-class Placentalia; its members include the rats, mice, squirrels and beavers, *i.e.* those animals which gnaw; it is the most widespread and largest order of the mammals. Characteristics are, ***a*** a large pair of chisel-like incisor teeth, with sharp cutting edges and enamel only on the front surface; ***b*** the incisor teeth grow continuously; ***c*** no canine teeth; ***d*** a few molar teeth, all for grinding. All rodents are small animals, and they breed prolifically. —***rodent*** (*n., adj.*) ↓ LAGOMORPHA · CHIROPTERA ↑ PLACENTALIA

CC200 Lagomorpha (*n.pl.*) An order of the sub-class Placentalia; it includes the rabbits and the hares. The members of the order are superficially similar to the rodents, but differ in having an extra pair of small incisor teeth in the upper jaw; their teeth are completely enamelled. —***lagomorph*** (*n., adj.*) ↑ RODENTIA

CC201 Chiroptera (*n.pl.*) An order of

Placentalia; its members include the bats. They are characterized by wings formed from a fold of skin extending between the very long digits of the forelimbs; they feed on insects or fruit. ↑ RODENTIA

CC202 Artiodactyla (*n.pl.*) An order of the sub-class Placentalia; it includes the even-toed ungulates, *e.g.* pigs, hippopotami, and the ruminants (cattle, sheep, goats, deer, antelope, camels and giraffes). Characteristics of the order are, ***a*** they have hooves; ***b*** they walk on their toes; ***c*** the third and fourth toes are the most developed and take all or most of the weight; ***d*** the number of toes may be four (in pigs and hippopotami) or more usually two (the cloven hoof in goats, sheep, cattle, etc.). —***artiodactyl*** (*n.*) ***artiodactylous*** (*adj.*) ↓ PERISSODACTYLA · SIRENIA · CETACEA · PROBOSCIDEA[1] · HYRACOIDEA · RUMINANTIA ↑ PLACENTALIA → MAMMALIA · UNGULATE

CC203 Perissodactyla (*n.pl.*) An order of Placentalia; its members include the horses, tapirs and rhinoceroses, *i.e.* the odd-toed ungulates. Characteristics of the order are, ***a*** they have hooves; ***b*** they walk on toes; ***c*** the third toe is the largest and takes all, or most, of the weight; the other toes are much reduced, and the animal may possess only one functional toe, *e.g.* the horse. —***perissodactyl*** (*n.*) ***perissodactylous*** (*adj.*) ↑ ARTIODACTYLA → UNGULATE

CC204 Sirenia (*n.pl.*) An order of Placentalia; its members include the dugongs and manatees (sea-cows). These animals are entirely aquatic and are either marine or estuarine; they possess flippers for forelimbs and vestigial hind-limbs. Characteristics of the order are, ***a*** a transversely expanded tail; ***b*** they are vegetarian in diet; ***c*** they have thick hair. In spite of many similarities with whales (Cetacea), there is no direct relationship to them. The members are restricted to warm regions. ↑ ARTIODACTYLA

CC205 Cetacea (*n.pl.*) An order of Placentalia, all of its members are aquatic and include the whales. Characteristics of the order are, ***a*** the back legs are absent, represented by much reduced bones; ***b*** the fore legs are reduced to paddles; ***d*** the tail has two large horizontal flukes; ***d*** a layer of subcutaneous fat (blubber); ***e*** a blowhole. There are two main groups, the toothed and the toothless whales. The members also include dolphins and porpoises. —***cetacean*** (*n., adj.*) ↑ ARTIODACTYLA

CC206 Proboscidea[1] (*n.pl.*) An order of Placentalia which includes the elephants. Characteristics of the order are, ***a*** a long trunk (proboscis); ***b*** long incisors (tusks) and large grinding molars; ***c*** the large size of the body and legs; ***d*** thick skin. ↑ ARTIODACTYLA → PROBOSCIS

CC207 Hyracoidea (*n.pl.*) An order of Placentalia which includes small ungulate animals, *e.g.* the gazelle, living in Africa and parts of Asia. Characteristics are, ***a*** short legs and a very short tail; ***b*** its small size. ↑ ARTIODACTYLA

CC208 Ruminantia (*n.pl.*) A sub-order of Artiodactyla containing deer, sheep, goats, antelopes, oxen. Characteristics are, they possess generally four, but sometimes three, stomachs; ***b*** no upper incisor teeth; ***c*** they generally possess bone-covered horns. ↑ ARTIODACTYLA → RUMEN

CC209 Carnivora (*n.pl.*) An order of Placentalia; characterized by, ***a*** feeding on other animals; ***b*** possessing well-developed canine teeth, and other specialized teeth for tearing flesh. Its members include dogs, cats, weasels, etc. —CARNIVORE (*n.*) ***carnivorous*** (*adj.*) ↓ PINNIPEDIA ↑ PLACENTALIA

CC210 Pinnipedia (*n.pl.*) A sub order of Carnivora, its members include the aquatic carnivores, *e.g.* seals and walruses. The distinguishing chracteristic is that they possess flippers instead of legs. Now usually considered a separate order of Placentalia. —***pinniped*** (*n., adj.*) ↑ CARNIVORA → PINNIGRADE

CC211 Primates (*n.pl.*) An order of the sub-class Placentalia, containing monkeys, apes, and man, and a few smaller mammals, such as lemurs and lorises. The members are adapted for arboreal life (climbing and grasping). Characteristics of the order are, ***a*** a well-developed first digit, *i.e.* the big toe and thumb, the latter often opposed in action to the remaining digits; ***b*** nails instead of claws; ***c*** well-developed eyesight, and often binocular vision; ***d*** a relatively large brain compared with other mammals. —***primate*** (*n.*) ↓ ANTHROPOIDEA · CATARRHINES · PLATYRRHINES · APE ↑ PLACENTALIA

CC212 Anthropoidea (*n.pl.*) A sub-order of Primates; its members are monkeys, apes, and man. The sub-order is divided into two groups of families, Catarrhines and Platyrrhines. Characteristics of the sub-order are, ***a*** large well-developed eyes, directed forwards; ***b*** prehensile hands, with power of manipulation; ***c*** a relatively large brain. —***anthropoid*** (*n., adj.*) ↑ PRIMATES

CC213 Catarrhines (*n.pl.*) A group of anthropoids in Europe, Asia, and Africa, *e.g.* the chimpanzee, baboon, and man. They are characterized by a narrow internasal septum, a menstrual cycle, and usually they are tailless. —***catarrhine*** (*adj.*) ↑ PRIMATES

CC214 Platyrrhines (*n.pl.*) A group of monkeys found in North and South America, *e.g.* marmosets. They are characterized by a broad internasal septum, and usually have prehensile tails. —***platyrrhine*** (*adj.*) ↑ PRIMATES

CC215 ape (*n.*) A type of monkey without a tail, capable of walking on two legs. The term usually refers to the higher primates, *e.g.* chimpanzees, orang utangs and gorillas. ↑ PRIMATES

General Morphology

CD001 morphology (*n.*) The study of the form and shape of living organisms or parts of organisms. Contrast ANATOMY, the study of the internal structures of organisms, and PHYSIOLOGY, the study of the functions of the structures of organisms. —MORPHOLOGICAL (*adj.*) ***morphologist*** (*n.*) ↓ SPINE[3] · EXTERNAL FEATURES · STING[2] · ECHINATE · MORPHOLOGICAL · PELLICLE · MICRO-ORGANISM → TREE · SKIN

CD002 spine[3] (*n.*) A sharp, pointed process on leaves, bones, and the skin of some animals (*e.g.* echinoderms). The spine can be long or short, needle-shaped or ridge-shaped. —SPINY (*adj.*) ↓ SPUR[1] · STING[1] ↑ MORPHOLOGY

CD003 spur[1] (*n.*) **1** A short, sharp, rigid outgrowth on the leg of some insects, and on the leg and wing of some birds. **2** Any structure resembling a spur, *e.g.* the long, hollow, pointed outgrowth from the corolla of some flowers. ↑SPINE[3]

CD004 sting[1] (*n.*) **1** A tubular, pointed, hair-like organ found in some animals which can puncture the skin of a victim and inject a poison or an irritant from a connected gland. **2** The wound, puncture, swelling or sensation of pain caused by such an organ. —***stinging*** (*adj.*) STING (*v.*) ↑ SPINE[3] → PUNCTURE

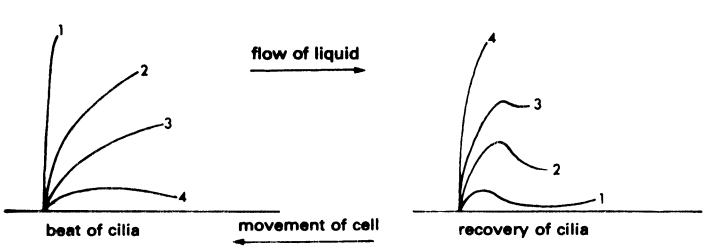
CD005 external features (*n.pl.*) The details of form and external appearance of an animal, which help in distinguishing different species, *e.g.* **a** hair is an external feature of mammals; **b** a tail is an external feature of a lion; **c** a tusk is an external feature of an elephant. ↑ MORPHOLOGY → FEATURE

CD006 sting[2] (*v.t.,i.*) **(stung, stung)** To wound with a sting □ *the man was stung by a bee* ↑ MORPHOLOGY · STING[1]

CD007 echinate (*adj.*) **1** (Of animals) bearing spines, *e.g.* the spiny ant-eater is echinate. **2** (Of plants) bearing bristles or spines. ↑ MORPHOLOGY

CD008 morphological (*adj.*) Of or to do with morphology, or the shape and external features of organisms. Contrast **anatomical** which concerns the internal structure of an organism. ↑ MORPHOLOGY

CD009 pellicle (*n.*) A delicate, protective covering, *e.g.* the investment of ciliate Protozoa, or the covering of a pileus. —PELLICULATE (*adj.*) ↓ CILIUM · PSEUDOPODIUM[1] · ENGULF[1] · CILIARY · MONOCERCOUS · AMOEBOID ↑ MORPHOLOGY



[CILIA]

CD010 cilium (*n., pl.* **cilia**) **1** A very small thread-like process projecting from a single cell, or from a cell on the surface of a tissue, usually occurring in great numbers. Cilia move in a regular rhythm of beat and recovery in a whip-like movement which either, **a** causes liquid to flow past the cell in one direction, or **b** moves the cell in the opposite direction. The motion of the cell, or liquid, is caused by the lashing of the cilia proceeding in waves along the surface of the cell. The movement of the cilia is in two dimensions only, usually perpendicular to the cell surface. Cilia are used by the Ciliata, (*e.g. Paramecium*) for locomotion. In other animals, cilia cause a flow of liquid over the surface of certain tissues, *e.g.* the epithelial tissues in the nose and trachea, where cilia cause a flow of mucus. Cilia on sedentary animals produce currents of water to sweep food into their mouths. □ *the cilia lash in one direction* **2** An eyelash. **3** The barbicel on a feather. —CILIATE (*n., adj.*), CILIATED, CILIARY (*adj.*) ↓ FLAGELLUM · CILIA · FLAGELLA[2] · FIMBRIA · PILUS[2] ↑ PELLICLE

CD011 flagellum (*n., pl.* **flagella**) A long, fine, thread-like process on a non-cellular (or unicellular) organism. Usually the organism possesses only one flagellum or possibly two. A flagellum is much longer than a cilium. Flagella are used for locomotion; their movement is in three dimensions, and is undulating in a wave-like or helical fashion. Bacteria may possess tufts or groups of flagella. —FLAGELLATA (*n.pl.*) FLAGELLATE (*n.,adj.*) ↑ CILIUM

CD012 cilia (*n.pl.*) See CILIUM.

CD013 flagella[2] (*n.pl.*) See FLAGELLUM.

CD014 fimbria (*n., pl.* **fimbriae**) **1** One of the numerous filaments, smaller than a

cilium, on the surface of some bacterial cells. Fimbriae are involved in the formation of a conjugation tube when bacteria undergo conjugation. **2** One of the numerous, delicate processes forming a fringe at the mouth of a tube or duct, *e.g.* an oviduct; a siphon (in molluscs). —***fimbriate*** (*adj.*) ↑ CILIUM

CD015 pilus[2] (*n., pl.* **pili**) A fine hair-like structure. An alternative term for **fimbria** ↑ FIMBRIA (Sn) · CILIUM

CD016 pseudopodium[1] (*n., pl.* **pseudopodia**) A temporary protrusion, with no fixed outline, from the cell of certain Protozoa (Sarcodina), *e.g. Amoeba*. Protoplasm flows into, and out of, the pseudopodium, changing its shape. A pseudopodium provides a means of locomotion (amoeboid movement) and a means of feeding (by engulfing). Pseudopodia are also formed by some macrophages. —***pseudopodal*** (*adj.*) ↑ PELLICLE → AMOEBA · MACROPHAGE

CD017 rhizopodium (*n., pl.* **rhizopodia**) A thread-like pseudopodium, which may branch like a root, or may form a network of pseudopodia through anastomosis. ↑ PSEUDOPODIUM[1] → ANASTOMOSIS

CD018 engulf[1] (*v.t.*) To enclose a food particle or other object with pseudopodia, which join and form a vacuole about the particle. The action occurs in certain Protozoa (Sarcodina) and in amoeboid cells found in Metazoa. ↑ PELLICLE

CD019 ciliary (*adj.*) **1** Of or to do with cilia, *e.g.* ciliary feeding. **2** Describes any structure of the vertebrate eye concerned with accommodation, *e.g.* ciliary body. ↓ CILIATE[2] · CILIATED · FLAGELLATE[2] · PELLICULATE ↑ PELLICLE

CD020 ciliate[2] (*adj.*) Alternative term for CILIATED. Ciliate is often applied to a group of organisms, *e.g. Ciliophora* are ciliate Protozoa. ↑CILIARY

CD021 ciliated (*adj.*) (Of a single organism, a group of organisms or a tissue) possessing cilia, *e.g.* ***a*** *Paramecium* is ciliated; ***b*** ciliated epithelial tissue in the trachea. ↑ CILIARY

CD022 flagellate[2] (*adj.*) **1** Possessing flagella, *e.g. Euglena viridis* is flagellate; it possesses one flagellum. **2** Like a flagellum. ↑ CILIARY

CD023 pelliculate (*adj.*) Having a pellicle on the outer surface. ↑ CILIARY

CD024 monocercous (*adj.*) Having only one flagellum. ↑ FLAGELLUM

CD025 amoeboid (*adj.*) Resembling an amoeba; describes a cell which uses pseudopodia for feeding purposes and for locomotion. ↑ PELLICLE

CD026 micro-organism (*n.*) An organism that can be seen under a microscope but cannot be seen by the naked eye. The term describes protists and bacteria, viruses and rickettsiae. ↓ CULTURE[1] · ANTIBIOSIS[2] · CULTURE[2] ↑ MORPHOLOGY

CD027 culture[1] (*n.*) A growth of micro-organisms in a suitable medium for scientific or medical purposes; bacteria and fungi are cultured in this way. The medium must be sterile before the culture is started, and must contain suitable nutrients. —CULTURE (*v.*) ***cultured*** (*adj.*) ↓ MEDIUM[2] · IN VIVO · IN VITRO ↑ MICRO-ORGANISM

CD028 medium[2] (*n.*) A substrate used for growing micro-organisms, usually called a culture medium; sterile broth and agar provide suitable mediums for many cultures. ↑ CULTURE[1]

CD029 in vivo (*adv.*) Describes a biological experiment carried out within a living organism, *e.g.* the culture of viruses in hens' eggs. ↓ IN VITRO (Cn) ↑ CULTURE[1]

CD030 in vitro (*adv.*) Describes a biological experiment carried out in isolation from a living organism, for example carried out in a test-tube, *e.g.* ***a*** experiments with enzymes extracted from organs; ***b*** the culture of tissue cells. ↑ CULTURE[1] · IN VIVO (Cn)

CD031 antibiosis[2] (*n.*) The phenomenon of antagonism between micro-organisms, including fungi, caused by the production of toxic substances (antibiotics). ↑ MICRO-ORGANISM → ANTIBIOTIC

CD032 culture[2] (*v.t.*) To grow required types of micro-organisms in a suitable medium. ↑ MICRO-ORGANISM

Plant Morphology

CE001 tree (*n.*) A woody perennial plant with a height, when full grown, of approximately 3 to 70 metres, a well-defined trunk containing heartwood and sapwood, and usually no branches from the trunk for several metres from the ground. ↓ SHRUB · FOLIATION · PHYLLOME · THORN · TRICHOME[1] · ABSCISE · DECIDUOUS · AXILLARY · LEAF · STOMA[2] · VEIN[3] · SIMPLE LEAF · COMPOUND LEAF · FRUIT → ARBOREAL · MORPHOLOGY

CE002 shrub (*n.*) A woody perennial plant usually with a height when fully grown of less than 3–4 metres; it has no well-defined trunk, and its branches are formed from near ground level. The stem never reaches any great girth. ↓ CREEPER · CAULOTAXIS · PHYTOMA · ECAD OECAD ↑ TREE

CE003 creeper (*n.*) A herbaceous plant with a stem that grows along the ground, putting down roots from time to time. The term is also applied to herbaceous plants that climb up supports (such as trees and shrubs) so that the leaves become more exposed to sunlight. ↑ SHRUB

CE004 caulotaxis (*n.*) The arrangement of branches on a stem or trunk. ↑ SHRUB

CE005 phytoma (*n.*) The structures of a plant, considered as a whole, except for sexual organs, *i.e.* the vegetative part of a plant. ↑ SHRUB

CE006 ecad (*n.*) A plant form modified owing to habitat; the characteristics are non-heritable. ↑ SHRUB

CE007 oecad (*n.*) Alternative term for ECAD. ↑ SHRUB

CE008 foliation (*n.*) The production of leaves. ↓ LEAF-FALL · ABSCISSION LAYER · DEFOLIATION · DEFOLIANT ↑ TREE

CE009 leaf-fall (*n.*) All trees and other perennial plants periodically lose their leaves, and the leaves are replaced. There are two types of leaf-fall, occurring in deciduous and evergreen plants. ↓ DECIDUOUS · EVERGREEN ↑ FOLIATION → ABSCISSION

CE010 abscission layer (*n.*) A layer of parenchymatous cells at the leaf base of woody dicotyledons, bounded on the stem (adaxial) side by a layer of cork. The middle layer of the parenchyma cells break down and the leaf is shed; the layer of cork plugs the vascular tissue. The same mechanism occurs in the dropping of flower stalks, fruits, etc. ↑ FOLIATION → ABSCISSION

CE011 defoliation (*n.*) The destruction of leaves on a plant. —DEFOLIANT (*n.*) ↑ FOLIATION

CE012 defoliant (*n.*) A substance that destroys leaves on a tree. ↑ FOLIATION

CE013 phyllome (*n.*) The leaf structures of a plant considered as a whole; it includes foliage leaves, scale leaves, floral leaves, bracts, cotyledons and modified leaves (tendrils, spines, thorns). ↓ FOLIAGE · AXIL · BUD[2] · APICAL BUD · LATERAL BUD · PREFOLIATION · PTYXIS · VERNATION · AESTIVATION[2] · CAULOME ↑ TREE → SCALE LEAF · FLORAL LEAF · BRACT · COTYLEDON · TENDRIL

CE014 foliage (*n.*) The whole mass of foliage leaves on a plant, usually a tree or shrub, but not a herb. ↑ PHYLLOME → FOLIAGE LEAF

CE015 axil (*n.*) The angle between a leaf and the upper part of the stem on which the leaf is borne □ *a bud is formed in an axil* ↑ PHYLLOME

CE016 bud[2] (*n.*) An undeveloped shoot on a stem; it consists of a very short stem with undeveloped leaves overlapping each other and covering the apex of the stem. The term is also used to describe an unopened flower or an unopened leaf. —BUD (*v.*) ↑ PHYLLOME

CE017 apical bud (*n.*) The bud at the apex of a stem or branch. ↑ PHYLLOME

CE018 lateral bud (*n.*) A bud normally found in the axil of a leaf. ↑ PHYLLOME

CE019 prefoliation (*n.*) The way in which foliage leaves fold over the apex of a stem in a bud. Prefoliation consists of **ptyxis** and **vernation.** ↑ PHYLLOME

CE020 ptyxis (*n.*) The condition of a leaf in a bud being rolled and folded to reduce the space it occupies in the bud. ↑ PHYLLOME

CE021 vernation (*n.*) **1** The arrangement of leaves in a bud relative to each other. **2** The way in which these leaves unroll. ↑ PHYLLOME → CIRCINATE

CE022 aestivation[2] (*n.*) The arrangement of the different parts of a flower in a flower-bud. ↑ PHYLLOME

CE023 caulome (*n.*) The stem structure of whole plants (including main stem and branches). ↑ PHYLLOME · CAULOTAXIS

CE024 thorn (*n.*) **1** A sharp-pointed, hard, woody structure on a plant. The term is generally used of true thorns, spines, and prickles. **2** A **true thorn** is a modified branch which has lost its apical growing point; it has a vascular system and may bear leaves. It is hard and woody with a sharp point. Contrast **hooks** which have a similar structure but are curved. —***thorny*** (*adj.*) ↓ SPINE[4] · SPINULE · PRICKLE · EMERGENCE[1] · APICAL DOMINANCE ↑ TREE

CE025 spine[4] (*n.*) A modified leaf or stipule which is small, rod-like and sharp pointed. ***spinose*** (*adj.*) ↑ THORN → STIPULE

CE026 spinule (*n.*) A small spine. ↑ THORN

CE027 prickle (*n.*) A sharp-pointed process which is a stem outgrowth from the epidermis; it comes through the epidermal tissues. —***prickly*** (*adj.*) ↑ THORN

CE028 emergence[1] (*n.*) An outgrowth from the epidermal or subepidermal tissues of a plant, *e.g.* a prickle. ↑ THORN

CE029 apical dominance (*n.*) In herbaceous plants and trees the aerial stem grows by the terminal bud, under the control of hormones which inhibit growth of lateral buds. This is apical dominance. If the terminal bud is removed or damaged the uppermost remaining lateral bud develops. ↑ THORN

CE030 trichome[1] (*n.*) An outgrowth of an epidermal cell of a plant; it is hair-like, but the size, shape and structure varies according to the function. It can be unicellular or multicellular; the latter can be branched or unbranched. Some trichomes are short-lived, being required for protection of a structure such as a bud; after losing their protoplasm they appear white. Other trichomes are persistent with cell walls impregnated with lignin, silica or calcium carbonate; such trichomes form sharp-pointed hairs for protection from enemies or form stiff hairs for climbing, especially when hooked. Root hairs are unicellular trichomes. Trichomes on leaves diminish transpiration and protect the leaf from insects. —***trichomic*** (*adj.*) ↓ SECRETORY TRICHOME · STINGING HAIRS · PILUS[1] ↑ TREE →ROOT HAIR

CE031 secretory trichome (*n.*) A trichome that is mainly multicellular with a stalk and a head; the secretions include gums, volatile oils and resins, often with a characteristic odour. ↑ TRICHOME[1]

CE032 stinging hairs (*n.pl.*) These are defensive trichomes; they consist of a broad base, with the hair tapering above it and ending in a knob-shaped tip. The hair is

reinforced with silica, and contains a poison accumulated in a cell or cells. The tip is broken off by contact, penetrating the skin and inoculating the poison. The poison consists of a histamine and acetylcholine. Stinging hairs are usually found on the surface of a lamina. ↑ TRICHOME[1] → LAMINA[1]

CE033 pilus[1] (*n., pl.* **pili**) **1** A slender hair-like structure on a plant; some plants are covered in pili. **2** An alternative term for FIMBRIA. —PILIFEROUS (*adj.*) ↑ TRICHOME[1] → FIMBRIA

CE034 abscise (*v.i.*) (Of leaves, fruit, flowers) to become separated; to fall off a plant. ↑ TREE → CAST[1] · ABSCISSION

CE035 deciduous (*adj.*) (Of perennial plants) shedding their leaves at a particular season (usually autumn in temperate climates) and passing through a period with no leaves. ↓ EVERGREEN (I) · SUCCULENT ↑ TREE

CE036 evergreen (*adj.*) (Of perennial plants) bearing leaves all the year round. Leaves are constantly being shed and fresh ones developed. ↑ DECIDUOUS (I)

CE037 succulent (*adj.*) (Of plants, stems, leaves and fruit) full of sap or juice. ↑ DECIDUOUS

CE038 axillary (*adj.*) Of, to do with, or growing in, an axil. ↑ TREE · AXIL

CE039 leaf (*n., pl.* **leaves**) An outgrowth at the node of a plant stem consisting of a leaf base, a stalk, and a thin flattened portion, the most conspicuous part of the leaf. It is generally green in colour and the flattened portion contains cells carrying out photosynthesis. A vascular system conducts water and mineral salts to all parts of the leaf and removes the products of photosynthesis. The leaves of some plants are modified, ***a*** for climatic conditions, or ***b*** to carry out special functions □ *a plant sheds its leaves; leaves are developed from buds* —***leafy, leafless*** (*adj.*) ↓ LEAF BASE · LAMINA[1] · FROND[1] · FOLIAR · AMPLEXICAUL · GLABROUS ↑ TREE → NODE[1]

CE040 leaf base (*n.*) The structure by which a leaf is attached to a stem. ↓ LEAF-SHEATH · LIGULE[2] · PETIOLE · PETIOLULE ↑ LEAF

CE041 leaf-sheath (*n.*) A modification of the base of a leaf forming a sheath round the stem, as found in grasses and other monocotyledons. ↑ LEAF BASE

CE042 ligule[2] (*n.*) The collar (a membranous outgrowth) at the junction of a lamina and leaf-sheath in a sessile leaf, *e.g.* as in leaves of grasses and sedges. ↑ LEAF BASE

CE043 petiole (*n.*) The stalk supporting the lamina of a leaf. Leaves without a petiole are called **sessile.** ↑ LEAF BASE → PEDUNCLE · STIPULE · PHYLLODE

CE044 petiolule (*n.*) The stalk supporting a leaflet. ↑ LEAF BASE

CE045 lamina[1] (*n., pl.* **laminae**) The flattened portion of a leaf; it can be of various shapes, and each plant species has a characteristic shape. Some plants have more than one type of lamina. ↓ LEAF BLADE · LEAFLET · FOLIAGE LEAF · LEAF MOSAIC · ROSETTE · PHYLLOTAXIS · SPIRAL PHYLLOTAXIS · WHORLED PHYLLOTAXIS · PHYLLOTAXY ↑ LEAF

CE046 leaf blade (*n.*) Alternative term for LAMINA[1].

CE047 leaflet (*n.*) An individual unit or division of a compound leaf. ↑ LAMINA[1]

CE048 foliage leaf (*n.*) The normal green leaf on a plant, as opposed to specialized leaves, such as scale leaves, bracts, floral leaves and cotyledons. ↑ LAMINA[1] → BRACT · FLORAL LEAF · COTYLEDON

CE049 leaf mosaic (*n.*) Leaves are so arranged on stems and branches that one leaf never completely overlaps another leaf; the spaces between leaves are narrow, and the result is that as many leaves as possible are directly exposed to sunlight. The pattern formed by the leaves in this arrangement is called the leaf mosaic □ *a close leaf mosaic allows little sunlight to pass the leaves* ↑ LAMINA[1] → PHYLLOTAXIS

CE050 rosette (*n.*) A cluster of leaves borne in close circles on a central axis. ↑ LAMINA[1]

CE051 phyllotaxis (*n.*) The arrangement of leaves on a stem or axis; it can be alternate, opposite, spiral or whorled phyllotaxis. The arrangement is usually represented by a fraction, *e.g.* a phyllotaxis of ½ describes a simple, truly alternate arrangement of leaves which are 180° apart; the fraction represents the angle made by successive leaves when looking vertically downwards on the stem. Various arrangements occur, *e.g.* a phyllotaxis of 1/3, 2/5, 5/13, etc. The phyllotaxis of a plant determines the leaf mosaic. —***phyllotactic*** (*adj.*) ↑ LAMINA[1] · LEAF MOSAIC (Cs)

CE052 spiral phyllotaxis (*n.*) A line connecting the points of attachment of the leaves forms a spiral round the stem, or axis. At the end of each spiral, a leaf is directly above the leaf at the beginning of the spiral, *e.g.* in a spiral phyllotaxis of 2/5, the sixth leaf is directly above the first leaf and the spiral has passed twice round the stem. The leaves are regularly positioned in a spiral phyllotaxis. Alternate phyllotaxis is the simplest form of a spiral. ↑ LAMINA[1]

CE053 whorled phyllotaxis (*n.*) A line connecting the points of attachment forms a circle round the stem. Opposite phyllotaxis is the simplest form of a whorled phyllotaxis. ↑ LAMINA[1]

CE054 phyllotaxy (*n.*) Alternative term for PHYLLOTAXIS. ↑ LAMINA[1]

CE055 frond[1] (*n.*) **1** The leaf-like structure of a fern. It consists of a stipe (which grows from a rhizome), a rachis (a prolongation of the stipe) and pinnae attached to the rachis. Its function is the same as that of a leaf. **2** The leaf of a palm tree. ↓ RAMENTUM · RAMENTA ↑ LEAF → RACHIS[3] · RHIZOME · PINNA[2]

CE056 ramentum (*n., pl.* **ramenta**) A brown, scale-like structure found on the fronds of ferns. ↑ FROND[1]

CE057 ramenta (*n.pl.*) Brown, elongated, membranous hairs covering the stem and young fronds of ferns. ↑ FROND[1]

CE058 foliar (*adj.*) Of, to do with, consisting of, or bearing, leaves. ↓ FOLIATE · ALTERNATE · DECUSSATE · WHORLED · APHYLLOUS ↑ LEAF

CE059 foliate (*adj.*) Having leaves, *e.g.* a living tree is only foliate when leaves are present, but it is always foliar, as it has the disposition to bear leaves. ↑ FOLIAR

CE060 alternate (*adj.*) Describes an arrangement of leaves in which one leaf grows at each node, successive leaves growing on opposite sides of the stem □ *the leaf arrangement is alternate* ↑ FOLIAR

CE061 decussate (*adj.*) Describes a leaf arrangement in which a pair of leaves at each node are opposite to each other, and set at right angles to the pairs of leaves above and below. ↑ FOLIAR

CE062 whorled (*adj.*) Describes the leaves of a plant with more than two leaves growing at a node. ↑ FOLIAR

CE063 aphyllous (*adj.*) Without leaves; never producing leaves. Compare **leafless** which means the plant normally has leaves, but has lost them (as deciduous plants do when leaves are shed). ↑ FOLIAR

CE064 amplexicaul (*adj.*) Describes a leaf base which extends around the stem at a node. ↓ DECURRENT · CIRCINNATE ↑ LEAF

CE065 decurrent (*adj.*) Describes a leaf base which extends from a node down through an internode, *i.e.* not ending sharply at a node. ↑ AMPLEXICAUL

CE066 circinnate (*adj.*) **1** Describes a structure rolled along the axis so that the apex is at the centre of a circle, (the way in which young fern fronds are rolled). **2** Describes the vernation of fern fronds, *i.e.* the way in which fern fronds unroll. Individual parts of the frond unroll in the same way. ↑ AMPLEXICAUL

CE067 glabrous (*adj.*) Describes a smooth lamina or stem surface; without hairs. ↓ HISPID (An) · TOMENTOSE (An) ↑ LEAF → HAIRY

CE068 hispid (*adj.*) (Of a plant lamina or stem) having the surface sparsely covered with stiff hairs or spines. ↑ GLABROUS (An)

CE069 tomentose (*adj.*) (Of a plant lamina or stem), closely covered with tangled hairs, forming a soft woolly felt. ↑ GLABROUS

CE070 stoma[2] (*n., pl.* **stomata**) **1** A pore in the epidermis of a leaf, especially on the underside of the leaf. Gaseous exchange takes place through stomata, which are connected to intercellular spaces in the spongy mesophyll. In dicotyledons, the stomata are scattered over the surface of the lamina; in many monocotyledons, they are arranged in rows parallel to the veins. **2** The same pore with guard cells. —STOMATAL, STOMATE (*adj.*) ↓ GUARD CELL · SCALE LEAF · STOMATAL[2] · TENDRILLOUS ↑ TREE → LENTICEL

CE071 guard cell (*n.*) A crescent-shaped cell, with walls unevenly thickened, those adjacent to the pore are thicker than the outer walls; there are two guard cells, one on either side of a stoma. Changes in turgor of the cell cause a change in shape. When turgor is high, the cells become crescent-shaped and open the stoma; when turgor is low, the cells become circular and close the stoma. Their function is the control of transpiration. ↑ STOMA[2] → TURGOR · TRANSPIRATION

CE072 scale leaf (*n.*) A rudimentary, strong leaf on a plant; it protects buds. ↓ STIPULE · TENDRIL · SPINE[5] · PHYLLODE ↑ STOMA[2]

CE073 stipule (*n.*) In many plants, one of two leaf-like processes developed on either side of the base of a petiole; it can be tendril-shaped or spiny. It protects the axillary bud and usually takes part in photosynthesis. ↑ SCALE LEAF → PETIOLE

CE074 tendril (*n.*) A specialized stem or leaf, or part of a leaf, modified to form a slender thread-like structure which may be branched or unbranched. Its function is either to twine round a support or to stick to a support by an adhesive disc at the tip (less common). It is found on climbing or creeping stems and supports the stem. —TENDRILLAR, TENDRILLOUS (*adj.*) ↑ SCALE LEAF

CE075 spine[5] (*n.*) A leaf reduced to a tiny green spine. This occurs in xerophytes and the purpose is to reduce transpiration while still carrying out photosynthesis. The spines are borne at nodes and are a few millimetres long. ↑ SCALE LEAF → XEROPHYTE

CE076 phyllode (*n.*) In some plants the lamina disappears, the petiole becomes flattened and leaf-like, and functions as a lamina; this is a phyllode. The veins in a phyllode are arranged parallel to one another. ↑ SCALE LEAF → PETIOLE

CE077 stomatal[2] (*adj.*) Of or to do with stomata, *e.g.* the stomatal index, which is the ratio of the number of stomata to the number of epidermal cells per unit area. ↓ STOMATE[2] ↑ STOMA[2]

CE078 stomate[2] (*adj.*) Having stomata. ↑ STOMATAL[2]

CE079 tendrillous (*adj.*) Possessing tendrils. ↓ TENDRILLAR ↑ STOMA[2]

CE080 tendrillar (*adj.*) Acting as a tendril, *e.g.* some plant stems are tendrillar, as they climb a support by twining. ↑ TENDRILLOUS

CE081 vein[3] (*n.*) A vascular bundle in a lamina. ↓ MID-RIB · MARGIN · COSTATE · ENTIRE[2] ↑ TREE · LAMINA[1]

CE082 mid-rib (*n.*) The large, central, primary vein of a lamina. ↓ VENATION · PARALLEL VENATION · RETICULATE VENATION ↑ VEIN[2]

CE083 venation (*n.*) The system of veins in a leaf, either their arrangement, or the veins themselves. There are two arrangements in angiosperms, parallel and reticulate. ↑ MID-RIB

CE084 parallel venation (*n.*) This arrangement is characteristic of monocotyledons; all the primary veins of the lamina are parallel to each other and inconspicuous anastomoses connect them. ↑ MID-RIB

CE085 reticulate venation (*n.*) This arrangement is characteristic of dicotyle-

dons; the veins form a complicated network in the lamina. In pinnately veined reticulate venation, there is a mid-rib with the network branching from it; in palmately veined reticulate venation, there are several primary veins radiating from the apex of the petiole, and the network branches from these primary veins. ↑ MID-RIB

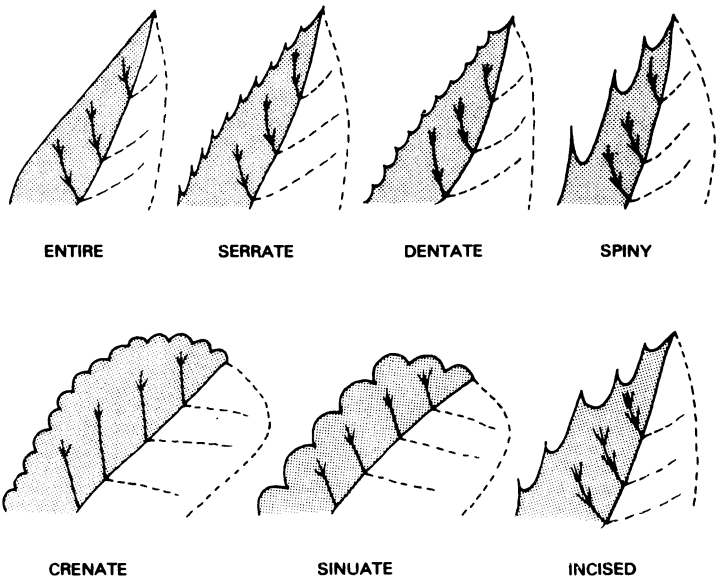
CE086 margin (*n.*) The edge of a leaf, and the surface next to the edge. A leaf margin can have various shapes, and in some plant species it is a different colour from the rest of the lamina. —***marginal*** (*adj.*) ↑ VEIN[3]

CE087 costate (*adj.*) (Of leaves) having one or more mid-ribs. ↓ UNICOSTATE · MULTICOSTATE · COSTAEFORM ↑ VEIN[3]

CE088 unicostate (*adj.*) (Of leaves) having only one prominent mid-rib, as in simple leaves. ↑ COSTATE

CE089 multicostate (*adj.*) (Of leaves) having several mid-ribs, as in palmate leaves. ↑ COSTATE

CE090 costaeform (*adj.*) Rib-like; describes unbranched parallel veins in a lamina, *e.g.* as in monocotyledons. ↑ COSTATE



CE091 entire[2] (*adj.*) **1** Describes a leaf margin which is smooth, *i.e.* with no indentations. **2** Describes a leaf with this kind of margin. ↓ SERRATE · DENTATE[2] · SPINY · CRENATE · SINUATE · INCISED · DENTICULATED ↑ VEIN[2]

CE092 serrate (*adj.*) (Of edges, leaf margins, or a leaf) having indentations in the shape of a saw, *i.e.* the shape of small teeth with the tips pointing towards the apex of the leaf. ↑ ENTIRE[2]

CE093 dentate[2] (*adj.*) Describes a leaf or leaf margin with larger teeth-shapes than in serrate leaves, and with the teeth pointing outwards and not towards the apex of the leaf. ↑ ENTIRE[2]

CE094 spiny (*adj.*) (Of leaf margins) having sharp points on small lobes. ↑ ENTIRE[2]

CE095 crenate (*adj.*) (Of a leaf or leaf margins) having small, shallow, regular curves. ↑ ENTIRE[2]

CE096 sinuate (*adj.*) (Of a leaf or leaf margins) having wave-like indentations. ↑ ENTIRE[2]

CE097 incised (*adj.*) (Of a leaf or leaf margins) formed with deep, often irregular, indentations. ↑ ENTIRE[2]

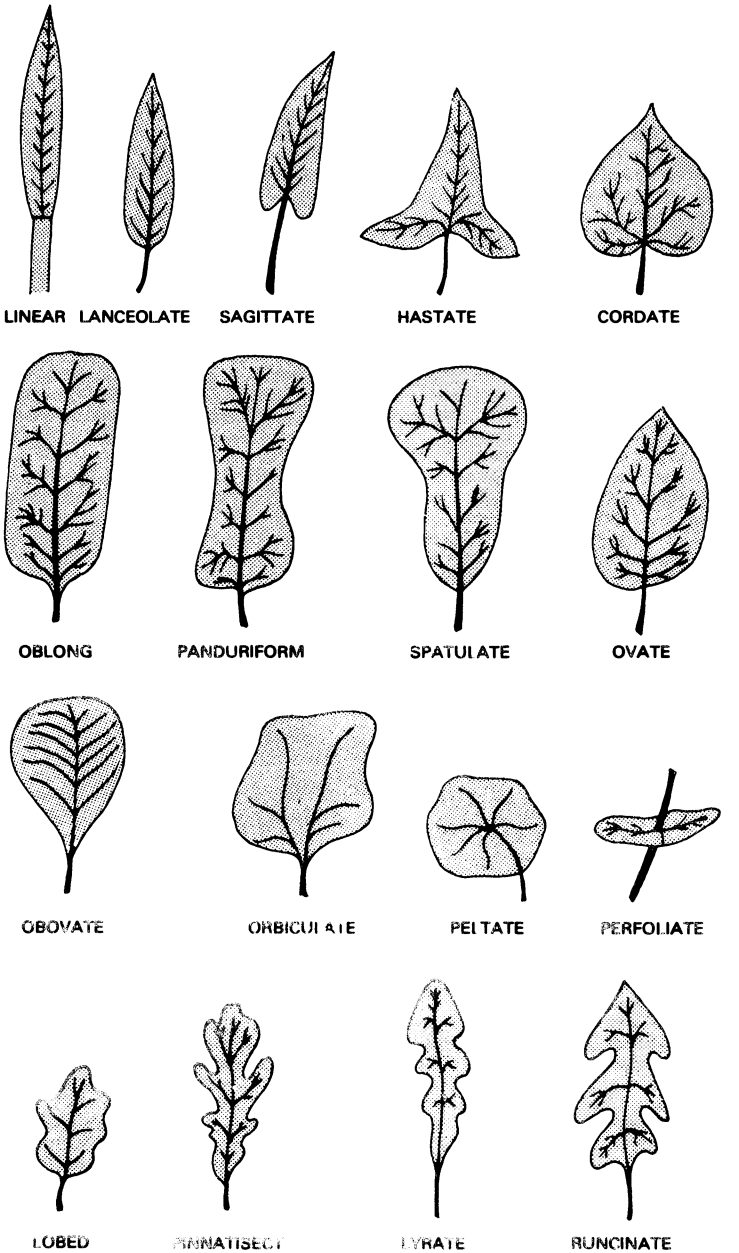
CE098 denticulated (*adj.*) Describes a leaf or a leaf margin with very small teeth, smaller than in a margin which is dentate, but similar in shape.

CE099 simple leaf (*n.*) A simple leaf has a lamina all in one piece; the margin may be deeply indented, but the indentations never reach the mid-rib. ↓ LINEAR[2] · OVATE · LOBED ↑ TREE

CE100 linear[2] (*adj.*) Describes a long, flat, narrow, simple leaf, with parallel margins, *e.g.* a grass leaf is linear. ↓ LANCEOLATE · SAGITTATE · HASTATE · CORDATE · OBLONG · PANDURIFORM · SPATULATE ↑ SIMPLE LEAF

CE101 lanceolate (*adj.*) Describes an elongated, simple leaf, tapering to a point at the apex. ↑ LINEAR[2]

CE102 sagittate (*adj.*) Describes an elongated, simple leaf tapering to a point, with the petiole attached to a deep indentation at the base; the two arms of the indentation


LINEAR
LANCEOLATE
SAGITTATE
HASTATE
CORDATE
OBLONG
PANDURIFORM
SPATULATE
OVATE
OBOVATE
ORBICULATE
PELTATE
PERFOLIATE
LOBED
PINNATISECT
LYRATE
RUNCINATE

are on either side of the petiole. ↑ LINEAR[2]

CE103 hastate (*adj.*) Describes a triangular simple leaf with two divergent triangular arms at the base. ↑ LINEAR[2]

CE104 cordate (*adj.*) Describes a broad, heart-shaped, simple leaf, pointed at the apex. ↑ LINEAR[2]

CE105 oblong (*adj.*) Describes a simple leaf more than twice as long as it is broad, with the longer sides parallel and the base and apex rounded. ↑ LINEAR[2]

CE106 panduriform (*adj.*) Describes an oblong-shaped simple leaf with concave sides. ↑ LINEAR[2]

CE107 spatulate (*adj.*) **1** Describes an elongated, simple leaf, narrow at the region near the base and ending in a short, broad, rounded apex. **2** Describes other structures of the same shape, *e.g.* digits of animals. ↑ LINEAR[2]

CE108 ovate (*adj.*) Describes a simple leaf shaped like a longitudinal section of an egg with the petiole attached to the broader end. ↓ OBOVATE · ORBICULATE · PELTATE · PERFOLIATE · CONNATE ↑ SIMPLE LEAF

CE109 obovate (*adj.*) Describes a simple leaf shaped like a longitudinal section of an egg, with the petiole attached to the narrower or more pointed end. ↑ OVATE

CE110 orbiculate (*adj.*) Describes a simple leaf which is almost completely round in shape; the margin may have a wavy edge. ↑ OVATE

CE111 peltate (*adj.*) Describes a round-shaped, simple leaf, with the petiole attached to a point near the centre of the lamina; the veins radiate from the petiole. The term is also applied to other similar plant structures, *e.g.* cones. ↑ OVATE

CE112 perfoliate (*adj.*) Describes a simple leaf with the base attached around the stem, so that the stem appears to pass through the leaf. ↑ OVATE

CE113 connate (*adj.*) Describes a pair of opposite, sessile, simple leaves, united at their bases; also called connate-perfoliate. The term is also applied to other structures similarly joined together. ↑ OVATE

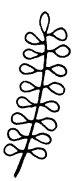
CE114 lobed (*adj.*) Describes a simple leaf with deep, curved indentations, forming lobes on the margin; the leaf is usually unicostate. ↓ PINNATIFID · PINNATISECT · LYRATE · RUNCINATE ↑ SIMPLE LEAF

CE115 pinnatifid (*adj.*) Describes a pinnately lobed, simple leaf with the indentations half-way to the mid-rib. ↑ LOBED

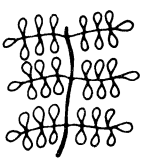
CE116 pinnatisect (*adj.*) Describes a pinnately lobed, simple leaf with the indentations almost to the mid-rib. ↑ LOBED

CE117 lyrate (*adj.*) Describes an elongated, simple leaf with a broad rounded lobe at the apex, and the lamina tapering to the petiole with a margin formed of small, opposite lobes marked by deep indentations. ↑ LOBED

CE118 runcinate (*adj.*) Describes a pinnatifid, simple leaf in which the lobes point backwards towards the base. ↑ LOBED



PINNATE



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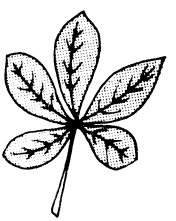


PALMATE (quinquefoliate)

CE119 compound leaf (*n.*) A compound leaf has the lamina divided into leaflets or lobes, whose margins extend to the mid-rib. ↓ PINNA[2] · TREFOIL · PINNATE · PALMATE ↑ TREE

CE120 pinna[2] (*n.*) A leaflet on a pinnate leaf. ↓ PINNULE · RACHIS[3] ↑ COMPOUND LEAF

CE121 pinnule (*n.*) A division of a pinna; a secondary leaflet of a bipinnate leaf. ↑ PINNA[2]

CE122 rachis[3] (*n.*) (Of a compound leaf) an axis to which the leaflets are attached. —***rachial*** (*adj.*) ↑ PINNA[2]

CE123 trefoil (*n.*) A leaf with three lobes or a flower with three petals. ↑ COMPOUND LEAF → TRIFOLIATE

CE124 pinnate (*adj.*) Describes a compound leaf with leaflets arranged on either side of a rachis or axis; there may or may not be a terminal leaflet at the apex of the rachis. —***pinnately*** (*adv.*) ↓ PARIPINNATE · BIPINNATE ↑ COMPOUND LEAF

CE125 paripinnate (*adj.*) Describes a pinnate leaf without a terminal leaflet, *i.e.* it consists of an even number of leaflets. ↑ PINNATE

CE126 bipinnate (*adj.*) Describes a pinnately compound leaf with the leaflets pinnately divided; the leaflets grow in pairs on paired axes. ↑ PINNATE

CE127 palmate (*adj.*) Describes a compound leaf with separate lobes attached to the petiole apex. ↓ TRIFOLIATE · QUINQUEFOLIATE · DIGITATE ↑ COMPOUND LEAF

CE128 trifoliate (*adj.*) Describes a palmate leaf with three lobes. ↑ PALMATE

CE129 quinquefoliate (*adj.*) Describes a palmate leaf with five lobes. ↑ PALMATE

CE130 digitate (*adj.*) Alternative term for PALMATE(↑).

CE131 fruit (*n.*) The ripened ovary of a flower produces a fruit; the ovary wall becomes dry or succulent, hard, fibrous or soft. An ovule in the ovary, if fertilized, develops into a seed in the fruit. A fruit shows two scars, one the attachment to the receptacle or peduncle, the other the remains of the stigma or style. A seed has only one scar. Fruits are categorized as simple, aggregate or multiple, and also as true or false □ *fruits can be dispersed by wind, by water, or by animals; fruits are usually formed after fertilization of a flower* ↓ PERICARP · EPICARP · RIND · FRUCTIFEROUS ↑ TREE → OVARY[2] · OVULE · PEDUNCLE · STIGMA[1] · STYLE[1]

CE132 pericarp (*n.*) (In a plant) the structure developed from the wall of an ovary during the formation of a fruit; the pericarp covers the seed or seeds in the fruit. In succulent fruits, the pericarp becomes clearly differentiated into three regions; epicarp, mesocarp, endocarp. ↓ FRUCTIFICATION · PARTHENOCARPY ↑ FRUIT → SUCCULENT

CE133 fructification (*n.*) **1** The formation of fruit, or the formation of any structure containing spores, especially when the formation arises from fertilization. **2** A fruit-body on a plant. **3** A spore-producing structure. —***fructify*** (*v.*) ↑ PERICARP → SPORE

CE134 parthenocarpy (*n.*) The condition of producing fruit without pollination of the flower, so that no seeds are produced in the fruit. —***parthenocarpic*** (*adj.*) ↑ PERICARP

CE135 epicarp (*n.*) The outer region or layer of a pericarp; it usually forms the skin of the fruit. ↓ MESOCARP · ENDOCARP · EXOCARP · MERICARP · SARCOCARP ↑ FRUIT

CE136 mesocarp (*n.*) The middle region of a pericarp; it can be fleshy, fibrous or pithy. ↑ EPICARP

CE137 endocarp (*n.*) The inner region of a pericarp; it can be fleshy, or hard and stony; it may enclose a seed. ↑ EPICARP → CREMOCARP

CE138 exocarp (*n.*) Alternative term for EPICARP.

CE139 mericarp (*n.*) A one-seeded part split off from a dry simple fruit; the fruit is formed from a syncarpous gynoecium. The mericarp is usually indehiscent. ↑ EPICARP

CE140 sarcocarp (*n.*) The fleshy or edible part of a fruit; it may be mesocarp or endocarp, or a swollen receptacle, or other structures of an inflorescence. The sarcocarp lies between the skin and the seed or a hard endocarp. ↑ EPICARP

CE141 rind (*n.*) An outer skin of a succulent fruit when there is an inner layer of pith beneath the rind, *e.g.* in hesperidia such as oranges, limes and lemons. ↓ PULP[2] · STONE · PIP · BURR ↑ FRUIT

CE142 pulp[2] (*n.*) The soft, fleshy part of a succulent fruit, either formed from a differentiated pericarp or from other flower structures. ↑ RIND

CE143 stone (*n.*) The term for the hard structure, usually a seed enclosed in an endocarp, found in a succulent fruit such as a drupe. ↑ RIND

CE144 pip (*n.*) The term for a seed, not enclosed in an endocarp, found in a succulent fruit such as a berry. ↑ RIND

CE145 burr (*n.*) A dry fruit covered in stiff, usually hooked, hairs. ↑ RIND

CE146 fructiferous (*adj.*) Fruit-producing. ↑ FRUIT

CE147 monocarpic[2] (*adj.*) Dying after bearing fruit once. ↑ FRUCTIFEROUS

CE148 polycarpic[2] (*adj.*) Producing fruit, or seed, season after season, *i.e.* a perennial plant. ↑ FRUCTIFEROUS

CE149 simple fruit (*n.*) One formed from a single flower; the flower can have one carpel or several fused carpels, *i.e.* either a monocarpous or a syncarpous gynoecium. ↓ ACHENE · CAPSULE[2] · CREMOCARP · DRUPE · PAPPUS · DEHISCENT · CAPSULAR · ABORTED ↑ TREE → CARPEL

CE150 achene (*n.*) An indehiscent dry fruit with one seed; a typical achene has a leathery pericarp, *e.g.* the fruit of the sunflower and buttercup. ↓ NUT · SAMARA · CYPSELA · CARYOPSIS ↑ SIMPLE FRUIT

CE151 nut (*n.*) An indehiscent dry fruit with one seed; the pericarp is woody and forms a hard shell, *e.g.* the fruit of the cashew nut and hazel nut. Note: many foods called nuts are not nuts in the biological sense, *e.g.* coconuts are drupes, groundnuts are legumes. ↑ ACHENE

CE152 samara (*n.*) An indehiscent dry fruit with one seed; the pericarp is extended to form a membranous wing, *e.g.* the fruit of the *Pterocarpus* and the maple. ↑ ACHENE

CE153 cypsela (*n.*) An indehiscent, dry fruit, with one seed, formed from a single flower with an inferior ovary; the pericarp often bears a crown of hair-like processes, a pappus, *e.g.* the fruits of *Tridex* and the dandelion. ↑ ACHENE

CE154 caryopsis (*n.*) An indehiscent dry fruit with one seed; the thin, membranous pericarp and the testa of the seed are completely fused. This is the typical fruit of a grass, *e.g.* maize, oat. ↑ ACHENE

CE155 capsule[2] (*n.*) A dehiscent dry fruit with many seeds; it is formed from two or more fused carpels. This is the most important and commonest type of dehiscent fruit. There are several methods of dehiscence, *e.g.* valvate, porose, etc. —CAPSULIFEROUS (*adj.*) CAPSULAR (*adj.*) ↓ FOLLICLE[1] · LEGUME[1] · POD[2] · SILICULA · SILIQUA ↑ SIMPLE FRUIT

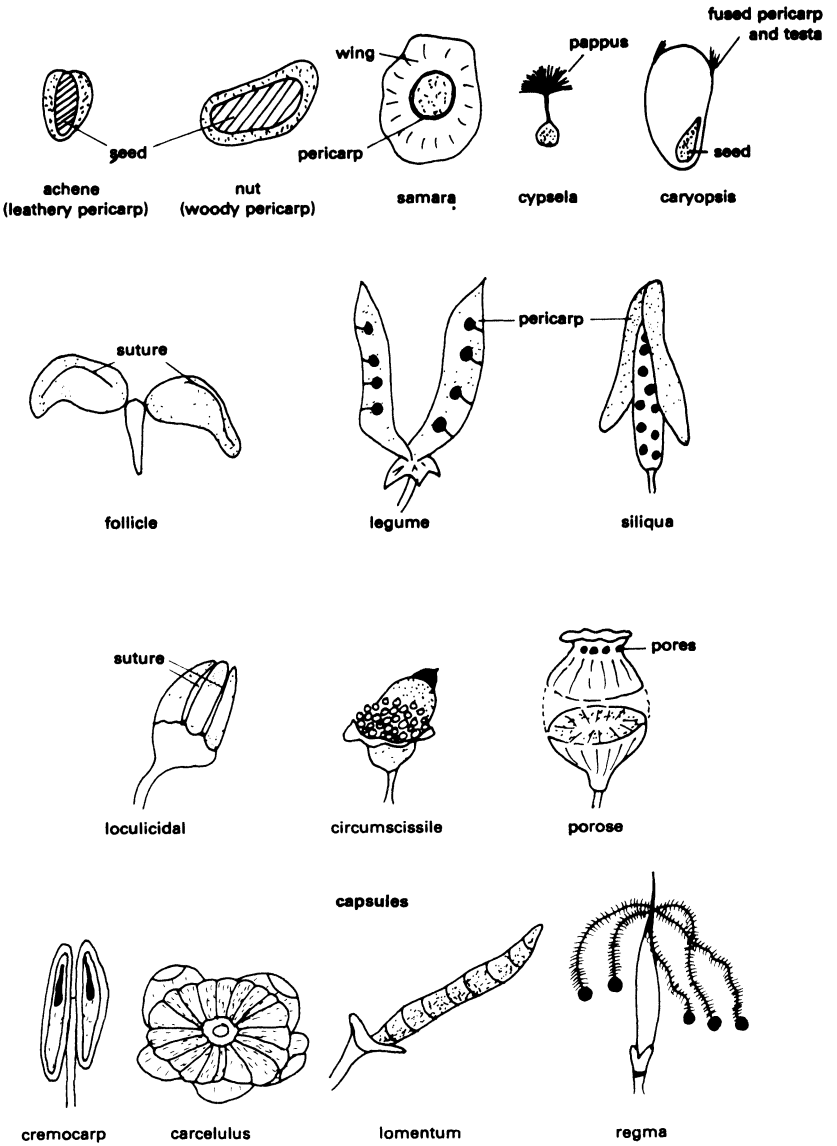
CE156 follicle[1] (*n.*) A dehiscent dry fruit formed from a single carpel; follicles usually occur in groups, being formed from apocarpous flowers. The dry pericarp splits along one side only; the line of splitting is called a suture, *e.g.* the fruit of *Cnestis*, delphinium. ↑ CAPSULE[2]

CE157 legume[1] (*n.*) A dehiscent, one-celled fruit formed from a single carpel and containing several seeds (the ovary has axile placentation); the pericarp consists of two

parts (or valves) and splits along two sutures joining the two parts. The seeds are joined to one of the suture lines. This is the typical fruit of the Leguminosae, *e.g.* pea, Crotalaria. ↑ CAPSULE[2]

CE158 pod[2] (*n.*) Alternative term for LEGUME.

CE159 silicula (*n.*) A dehiscent, dry fruit formed from two fused carpels; the fruit is divided in two by a false septum arising from the flower stalk. When ripe, the carpel walls split off and diverge, and the seeds are liberated. The fruit is broad and flat and can be wider than it is long, *e.g.* the fruit of honesty. —***silicular*** (*adj.*) ↑ CAPSULE[2]



DRY FRUITS

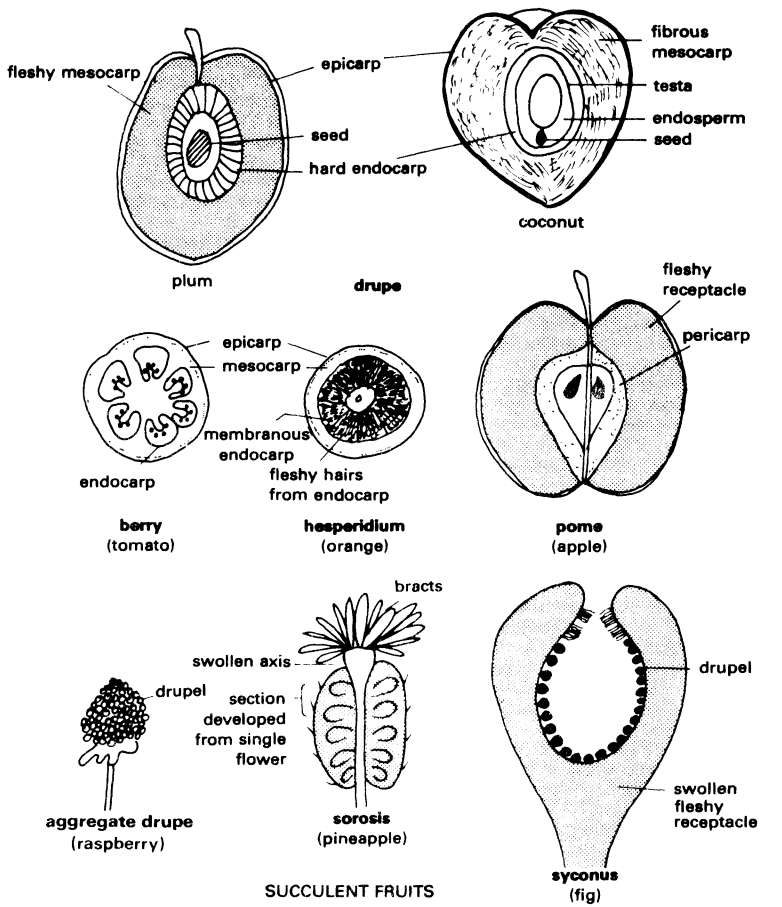
CE160 siliqua (*n.*) A dehiscent, dry fruit, which is long and cylindrical and whose structure and method of dehiscence are like those of a silicula, *e.g.* the fruit of mustard, cabbage. ↑ CAPSULE[2]

CE161 cremocarp (*n.*) A dry, schizocarpic fruit, with two indehiscent locules each containing one seed; when ripe, the fruit splits to separate the two locules into two mericarps, each with one seed, *e.g.* the fruit of *Heracleum*. ↓ CARCERULUS · LOMENTUM · REGMA ↑ SIMPLE FRUIT

CE162 carcerulus (*n.,pl.* **carceruli**) A dry, schizocarpic fruit formed from many carpels joined by united styles to a common axis; each cell or division contains one or a few seeds. When ripe, the fruit splits, separating the indehiscent one-seeded divisions, *e.g.* the fruits of the dead-nettle. ↑ CREMOCARP

CE163 lomentum (*n., pl.* **lomenta**) A dry schizocarpic fruit in the form of a legume or siliqua, with constrictions formed between the seeds as the fruit matures. When ripe, the fruit splits along the constrictions forming one-seeded, indehiscent parts (*i.e.* mericarps), *e.g.* fruits of birds-foot (a legume), radish (a siliqua). —***lomentaceous*** (*adj.*) ↑ CREMOCARP

CE164 regma (*n.*) A dry, schizocarpic fruit, with several separate, round, one-seeded divisions attached to the axis, *e.g.* the fruits of *Eradium*. ↑ CREMOCARP



SUCCULENT FRUITS

CE165 drupe (*n.*) A succulent fruit with one or more seeds; the pericarp is differentiated into a thin epicarp forming the skin, a fleshy mesocarp, and a hard, stony endocarp enclosing the seed, *e.g.* the fruits of the plum, mango and cherry. A coconut is a fibrous drupe with a fibrous mesocarp. ↓ BERRY · HESPERIDIUM ↑ SIMPLE FRUIT

CE166 berry (*n.*) A succulent fruit with many seeds; it is formed from a single flower with several fused carpels (syncarpous gynoecium). The pericarp is differentiated into a thin epicarp forming the rind and a fleshy sarcocarp formed from mesocarp and endocarp. Each seed is enveloped in a hard testa, *e.g.* tomato, nutmeg, banana, papaya. ↑ DRUPE

CE167 hesperidium (*n.,pl.* **hesperidia**) A succulent fruit with many seeds formed from a single syncarpous flower; the epicarp and mesocarp are joined together to form a thick skin; the endocarp projects into the middle of the fruit as membranous partitions forming chambers. Fleshy hairs from the endocarp form the pulp of the fruit, *e.g.* the orange, lime and lemon. ↑ DRUPE

CE168 pappus (*n.*) A circle or tuft of hairs developed from a persistent calyx; its function is to act as a float and allow fruits to be dispersed by wind, *e.g.* as on the fruit of a sun-flower. ↓ PARACHUTE · CENSER MECHANISM ↑ SIMPLE FRUIT → CALYX

CE169 parachute (*n.*) A special structure on a fruit or seed, such as a pappus, caruncle, wing or aril, which assists dispersal by wind by allowing the fruit or seed to float in the air and descend gradually. ↑ PAPPUS

CE170 censer mechanism (*n.*) The method of seed dispersal in which seeds are thrown out of a capsule through pores, by the capsule shaking in the wind. ↑ PAPPUS

CE171 dehiscent (*adj.*) **1** Describes a structure, particularly a dry fruit, which opens spontaneously along defined lines or in defined directions; **2** Describes a fruit opening to liberate seeds when ripe. —***dehiscence*** (*n.*) ***dehisce*** (*v.*) ↓INDEHISCENT (An) · SCHIZOCARPIC ↑ SIMPLE FRUIT

CE172 indehiscent (*adj.*) Describes a dry fruit which does not open spontaneously to liberate seeds when ripe. ↑ DEHISCENT (An)

CE173 schizocarpic (*adj.*) Describes a dry fruit, formed from several united carpels (syncarpous gynoecium), which splits into two or more indehiscent mericarps when the fruit is ripe. ↑DEHISCENT

CE174 capsular (*adj.*) **1** Of, to do with, or like a capsule. **2** Describes schizocarpic fruits, *e.g.* a follicle, legume, silicula or siliqua. ↓ VALVATE · LOCULICIDAL · CIRCUMSCISSILE · SEPTICIDAL · POROSE · PORICIDAL ↑ SIMPLE FRUIT

CE175 valvate (*adj.*) (Of a capsule) dehiscent longitudinally from apex to base, the separated parts being called valves. ↑ CAPSULAR

CE176 loculicidal (*adj.*) (Of a capsule) dehiscent down the middle of the carpels which form the wall of the capsule, *e.g.* the capsules of cotton and the castor oil plant. ↑ CAPSULAR

CE177 circumscissile (*adj.*) (Of a capsule) dehiscent round a transverse circular (generally equatorial) line, *e.g.* the capsule of cock's comb. ↑ CAPSULAR

CE178 septicidal (*adj.*) (Of a capsule) dehiscent at a septum. ↑ CAPSULAR

CE179 porose (*adj.*) (Of a capsule) dehiscent at the apex to form pores through which seeds are liberated, *e.g.* the capsule of the poppy. ↑ CAPSULAR

CE180 poricidal (*adj.*) Alternative term for POROSE. ↑ CAPSULAR

CE181 aborted (*adj.*) Describes an ovule that is not fertilized and so does not develop into a seed; used to describe such an ovule in a fruit. ↑ SIMPLE FRUIT

CE182 true fruit (*n.*) A fruit formed only from the ovary of a flower; no structures are incorporated into the fruit. ↓ AGGREGATE FRUIT · MULTIPLE FRUIT · PSEUDOCARP ↑ TREE

CE183 aggregate fruit (*n.*) A fruit formed from a single flower having several free carpels, each forming a separate ovary, i.e. an apocarpous gynoecium. Each ovary develops into a simple fruit, and the whole fruit is an aggregate of the small simple fruits, *e.g.* the raspberry. ↓ AGGREGATE DRUPE · DRUPEL · COMPOUND FRUIT ↑ TRUE FRUIT

CE184 aggregate drupe (*n.*) A fruit which is a collection of drupels borne on an axis, *e.g.* the raspberry and blackberry. ↑ AGGREGATE FRUIT

CE185 drupel (*n.*) A small drupe in an aggregate fruit. ↑ AGGREGATE FRUIT

CE186 compound fruit (*n.*) Alternative term for AGGREGATE FRUIT (↑).

CE187 multiple fruit (*n.*) A fruit formed from an inflorescence; parts of the flower other than the ovary wall form the fruit, so it is a pseudocarp. ↓ SYCONUS · SOROSIS · COMPOSITE FRUIT · SYCONIUM ↑ TRUE FRUIT

CE188 syconus (*n.*) A pseudocarp; a succulent multiple fruit formed from an inflorescence; the receptacle becomes swollen and fleshy, and forms a cup-like hollow in which the seeds are attached to the concave surface, *e.g.* the fig, the banyan. ↑ MULTIPLE FRUIT

CE189 sorosis (*n.*) A pseudocarp; a multiple fruit formed from a whole inflorescence, which is a spike with succulent sepals. The axis becomes swollen and either fleshy or woody; a sarcocarp is developed from the spike, *e.g.* the pineapple, the jackfruit. ↑ MULTIPLE FRUIT

CE190 composite fruit (*n.*) Alternative term for MULTIPLE FRUIT(↑).

CE191 syconium (*n.*) Alternative term for SYCONUS (↑).

CE192 pseudocarp (*n.*) A fruit in which parts of a flower other than the ovary wall are modified in the fruit, *e.g.* a swollen succulent receptacle. A pseudocarp can be formed from a single flower or from an inflorescence, *e.g.* a pome, a sorosis, a syconus. ↓ POME · FALSE FRUIT ↑ TRUE FRUIT

CE193 pome (*n.*) A pseudocarp formed from a single flower with fused carpels; the receptacle becomes swollen and fleshy and grows to enclose the true fruit (the core of the pome). The leathery pericarp encloses several divisions, each of which contains a seed, *e.g.* the apple, the pear. ↑ PSEUDOCARP

CE194 false fruit (*n.*) Alternative term for PSEUDOCARP (↑).

Animal Morphology

CF001 skin (*n.*) The external protective covering on an animal's body and appendages, joined by connective tissue to the muscles. In invertebrates it consists of epithelium on a basement membrane and a hypodermis may be present. In vertebrates it consists of an inner dermis and an outer epidermis. ↓ HORN · ANTLER · SCALE[2] · NAIL · SEBACEOUS · DERMIS · HAIR · SHELL[1] · WING · FEATHER · CAUDA · TENTACLE ↑ MORPHOLOGY → INTEGUMENT[1] · EPITHELIUM · HYPODERMIS[1]

CF002 horn (*n.*) A hard substance formed from animal cells impregnated with keratin. The horns of animals are formed from bone covered in horn. —***horny*** (*adj.*) ↓ SEBUM ↑ SKIN → KERATIN

CF003 sebum (*n.*) (Of mammals) a fatty substance secreted on to the surface of the skin; it lubricates the skin and hair, and keeps them waterproof. ↑ HORN

CF004 antler (*n.*) (Of some mammals, such as deer) a type of horn formed completely from bone and shed every year; an antler usually has a branching structure. ↑ SKIN

CF005 scale[2] (*n.*) A thin plate of bone, horn, or chitin, which is a dermal or epidermal outgrowth of animals. Cartilaginous fish have placoid scales; bony fish have bony overlapping scales; some reptiles have horny scales. —***scaly*** (*adj.*) ↓ PLACOID SCALE · SQUAMA · COSMOID SCALE · GANOID SCALE · LEPIDOSIS · WEB[2] ↑ SKIN → CHITIN · BONE

CF006 placoid scale (*n.*) Alternative term for DENTICLE. Placoid scales completely cover the skin of elasmobrachs, such as dogfish. ↑ SCALE[2] → DENTICLE

CF007 squama (*n., pl.* **squamae**) Alternative term for SCALE[2] (↑). —SQUAMOSE, SQUAMOUS (*adj.*)

CF008 cosmoid scale (*n.*) A thick, bony scale consisting of three layers: an outer layer consisting of dentine with pulp cavities and a thin, superficial layer of ganoine; a middle layer of loose, vascular bone; an inner layer of compact, laminated bone. Growth occurs in the inner layer only. ↑ SCALE[2] → GANOINE

CF009 ganoid scale (*n.*) A scale of primitive fish; it resembles a cosmoid scale in construction but has a much thicker layer of ganoine. It grows in thickness by adding to both the inner laminated bony layer and to the ganoine. ↑ SCALE[2] · COSMOID SCALE → GANOINE

CF010 lepidosis (*n.*) The character and arrangement of scales on animals. ↑ SCALE[2]

CF011 web[2] (*n.*) A layer of thin, soft skin stretched between the digits of certain aquatic animals such as amphibians and aquatic birds; the skin of webbed feet. —***webbed*** (*adj.*). ↑ SCALE[2]

CF012 nail (*n.*) (Of some mammals) a horny plate at the distal end of a finger or toes; it is formed by the epidermis. ↓ HOOF · CLAW · TALON · PAD ↑ SKIN → EPIDERMIS

CF013 hoof (*n., pl.* **hooves**) (Of the ungulate mammals) a modified nail, composed of horn, in the shape of a thick, curved plate forming the base of the foot. ↑ NAIL

CF014 claw (*n.*) A sharp, pointed, curved, rod-like nail; in some mammals, such as dogs, the claws are fixed; in other mammals, such as cats, the claws are retractile. ↑ NAIL

CF015 talon (*n.*) (Of birds) a large, sharp, hooked claw used for wounding and for gripping prey. ↑ NAIL

CF016 pad (*n.*) An area of thick skin on the underside of the foot or of the digits in some vertebrates; it protects the foot from injury. ↑ NAIL

CF017 sebaceous (*adj.*) **1** Of or to do with the secretion of fatty substances. **2** (Of a structure) containing or secreting fatty substances. ↓ CUTANEOUS · LEPIDOTE · DESQUAMATED · SQUAMOUS[2] · SQUAMOSE · SQUAMIFEROUS ↑ SKIN

CF018 cutaneous (*adj.*) Of or to do with the skin of animals, *e.g.* the cutaneous tissues of mammals bear hair. ↑ SEBACEOUS

CF019 lepidote (*adj.*) Covered with minute scales or scale-like hairs. ↑ SEBACEOUS

CF020 desquamated (*adj.*) Shed in small pieces, which come off continually, *e.g.* the cells of the outer layer (stratum corneum) of the skin. —***desquamate*** (*v.*) ↑ SEBACEOUS → STRATUM CORNEUM

CF021 squamous[2] (*adj.*) (Of scaly epithelia) consisting of scales, *e.g.* the skin of a lizard is squamous as it is covered with horny epidermal scales. ↑ SEBACEOUS

CF022 squamose (*n.*) Covered with scales; an identifying feature of an animal with scales on its skin, *e.g.* many reptiles are squamose. ↑ SEBACEOUS

CF023 squamiferous (*adj.*) Bearing or producing scales. ↑ SEBACEOUS

CF024 dermis (*n.*) (Of vertebrates only) the inner layer of the skin; it is composed of connective tissue, blood and lymph vessels, muscles and nerves. Collagen fibres are abundant in the dermis and run parallel to

the skin surface; they give the skin elasticity. Sweat glands and hair follicles are scattered throughout the dermis. The dermis is much thicker than the epidermis and is developed from mesoderm. —***dermal*** (*adj.*) ↓ EPIDERMIS[2] · ALBINISM · DERMATITIS ↑ SKIN → COLLAGEN · SWEAT GLAND · HAIR FOLLICLE

CF025 epidermis[2] (*n.*) **1** (Of invertebrates) an outer layer, one cell thick, on the epithelium; it may secrete a non-cellular cuticle. Compare hypodermis. **2** (Of vertebrates) the outer layer of the skin. In terrestrial vertebrates the epidermis is composed of two layers, the stratum corneum and the Malpighian layer. In aquatic vertebrates, *e.g.* fish and amphibians, the epidermis is composed of a single layer of tissue; in fish, scales cover the epidermis. Hair, nails, claws, feathers and scales are outgrowths of the epidermis. The epidermis is developed from ectoderm. —***epidermal*** (*adj.*) ↓ MALPIGHIAN LAYER · STRATUM MALPIGHII · STRATUM CORNEUM · CORNIFIED LAYER · HORNY LAYER ↑ DERMIS → EPITHELIUM · ECTODERM

CF026 Malpighian layer (*n.*) The inner layer of the epidermis. It consists of stratified living cells which frequently undergo binary division; the outermost cells are flattened and pushed towards the stratum corneum. The cells lose their protoplasm, become horny from impregnation with keratin, and are pushed into the stratum corneum. ↑ EPIDERMIS[2]

CF027 stratum Malpighii (*n.*) Alternative term for MALPIGHIAN LAYER.

CF028 stratum corneum (*n.*) The outer layer of the epidermis. It consists of stratified, dead, keratinized, cells; they are continually rubbed off (desquamated) and replaced by cells coming up from the Malpighian layer. The function of the stratum corneum is to protect the body against water loss, entry of pathogens, and ultra-violet rays of the sun. ↑ EPIDERMIS[2] → KERATIN

CF029 cornified layer (*n.*) Alternative term for STRATUM CORNEUM.

CF030 horny layer (*n.*) Alternative term for STRATUM CORNEUM.

CF031 albinism (*n.*) A condition in mammals, including man, in which skin pigments fail to develop owing to a single recessive gene. ↓ ALBINO ↑ SKIN → GENE · RECESSIVE

CF032 albino (*n.*) An individual exhibiting albinism. ↑ ALBINISM

CF033 dermatitis (*n.*) Inflammation of the surface of the skin. ↓ DERMATOSIS · URTICARIA ↑ DERMIS

CF034 dermatosis (*n.*) Any disease of the skin. ↑ DERMATITIS

CF035 urticaria (*n.*) A skin disease marked by small red pimples and itching. It is caused by various factors, *e.g.* plant toxins, animal stings, a change from normal diet. ↑ DERMATITIS

CF036 cast[1] (*v.t.*) **1** To shed, *e.g.* a snake casts its skin when it wriggles free from the whole, old, dead skin. **2** To put or push out, *e.g.* an earth-worm casts its faeces in a coil (a worm-cast) □ *the old skin is cast off; the cast-off old skin* —***cast*** (*n.*) ↓ SLOUGH[1] (Sn) ↑ DERMIS

CF037 slough[1] (*v.t.,i.*) **1** (*v.i.*) To be shed or cast off in pieces. **2** (*v.t.*) To shed or cast off pieces of skin, etc., *e.g.* **a** an animal sloughs its skin; ***b*** dead tissues slough from a purulent wound. —***slough*** (*n.*) ↑ CAST[1] (Sn) → PURULENT

CF038 hair (*n.*) **1** A thread-like outgrowth from the skin of mammals. Each hair is a slender rod composed of dead cells strengthened by keratin but remaining soft and supple; it grows from a hair follicle, and its length varies according to species and the part of the body on which it is growing. A hair is composed of a central pith (or medulla), surrounded by a more solid cortex, and enclosed in a thin, hard, cuticle. The pith contains air, and at its end the hair is hollow. Hair is formed from ectodermal epidermis. The functions of hair are, ***a*** the conservation of heat (the most important function); ***b*** protection from attack. Hair is kept supple by sebum. Modifications of hair are seen in cats' whiskers, which are more sensitive to touch than normal hair, and in the hardening of hair to form spines for protection, *e.g.* in porcupines and hedgehogs. **2** (In plants) a thread-like outgrowth from an epidermal cell, containing protoplasm, *e.g.* root hairs □ *a body covered with hair* —***hairy, hairless*** (*adj.*) ↓ HAIR FOLLICLE · BRISTLE (H) · WHISKER (H) · SETA · SETACEOUS → SKIN

CF039 hair follicle (*n.*) A follicle surrounding the root and shaft of a hair, formed by invagination of the epidermis; it penetrates deep into the dermis. The duct from a sebaceous gland opens into it, and a muscle attached to it is able to erect the hair. ↓ HAIR BULB · SEBACEOUS GLAND · ERECTOR MUSCLE ↑ HAIR → FOLLICLE

CF040 hair bulb (*n.*) A group of epidermal cells actively dividing to form the cells for a hair; the cells are hardened with keratin into non-living cells to form the hollow shaft of the hair. ↑ HAIR FOLLICLE

CF041 sebaceous gland (*n.*) A gland secreting sebum; its duct leads into a hair follicle. ↑ HAIR FOLLICLE → SEBUM

CF042 erector muscle (*n.*) A smooth muscle attached to a hair follicle, able to erect the hair when it contracts. ↑ HAIR FOLLICLE

CF043 bristle (*n.*) A short stiff hair. A bristle differs from a hair in being stiff and not supple; it is usually short, elastic and after bending will spring back into position. Short hairs often resemble bristles, but the hairs are softer. —***bristle*** (*v.*) ***bristly*** (*adj.*) ↓ WHISKER (H) · VIBRISSA · BARB[1] · FUR · MANE ↑ HAIR

CF044 whisker (*n.*) A long bristle on the face, *e.g.* the whiskers on a cat or dog. ↑ BRISTLE

CF045 vibrissa (*n., pl.* **vibrissae**) A whisker on the face of most mammals, usually near

the nose or mouth, especially noticeable on cats; it acts as a touch receptor. ↑ BRISTLE

CF046 barb[1] (*n.*) A hooked bristle. —***barbed*** (*adj.*) ↑ BRISTLE

CF047 fur (*n.*) **1** The thick covering of soft, upright hair on the skins of mammals; it provides efficient insulation especially for those living in cold climates. **2** An undercoat of soft, short hair on mammals having an outer coat of stiffer hair. **3** A deposit on the tongue produced by disease or bad digestion □ *the animal is covered with fur* —***furry, furred*** (*adj.*) ↑ BRISTLE

CF048 mane (*n.*) The tufts of long hair, forming a collar round the neck, or forming a line along the neck, found on some mammals; its function is to provide protection for the vertebral column in the neck. ↑ BRISTLE

CF049 seta (*n., pl.* **setae**) **1** A small thin bristle-like outgrowth other than a true hair; the term may refer to, ***a*** an outgrowth from the skin of an animal; ***b*** a bristle or scale of chitin on the cuticle of an arthropod. A seta is hollow and encloses an epidermal cell or part of such a cell. **2** A thin stiff epidermal outgrowth from a plant. —SETULE (*n.*) SETIFEROUS, SETACEOUS (*adj.*) ↓ CHAETA (H) · SETULE ↑ HAIR

CF050 chaeta (*n., pl.* **chaetae**) A thin, stiff outgrowth, like a bristle, from the skin of some segmented worms (*Annelida*). Chaetae are S-shaped bristles of chitin. They are locomotory organs and are retractile and protractile. They differ from setae in consisting solely of cuticular material. —***chaetotaxy*** (*n.*) ***chaetal, chaetiferous*** (*adj.*) ↑ SETA

CF051 setule (*n.*) A small seta; a fine bristle. Also called ***setula.*** ↑ SETA

CF052 setaceous (*adj.*) **1** Bristle-like, or like a seta. **2** Bearing bristles or setae. ↓ SETIFEROUS · SETIGEROUS · CHAETAL · CHAETIFEROUS · PILIFEROUS · HIRSUTE · PUBESCENT ↑ HAIR

CF053 setiferous (*adj.*) Bearing setae; also ***setigerous.*** ↓ CHAETIFEROUS (H) ↑ SETACEOUS

CF054 setigerous (*adj.*) Describes a structure bearing setae, *e.g.* setigerous sacs in some worms from which setae arise. ↑ SETACEOUS

CF055 chaetal (*adj.*) Of, or to do with, chaetae, *e.g.* the chaetal muscles which retract and protrude chaetae of certain *Annelida*. ↑ SETACEOUS

CF056 chaetiferous (*adj.*) Bearing chaetae, *e.g.* the chaetiferous annelids are those with chaetae, the *Chaetopoda*. ↑ SETACEOUS

CF057 setiparous (*adj.*) Describes a structure producing bristles or setae, *e.g.* the epidermis of some insects is setiparous ↑ SETACEOUS

CF058 piliferous (*adj.*) Bearing or producing hairs or hair-like structures, *e.g.* the piliferous layer of a root. ↑ CHAETAL

CF059 hirsute (*adj.*) Covered with stiff hairs or bristles. ↑ SETACEOUS

CF060 pubescent (*adj.*) Covered with short, soft hair ↑ SETACEOUS

CF061 shell[1] (*n.*) **1** The hard, protective cover for the soft body of a number of invertebrates, and a form of protection for a few vertebrates. A shell can be calcareous, siliceous, horny, bony or chitinous, and is harder than a cuticle, *e.g.* ***a*** the shell of a crab; ***b*** the shell of a snail; ***c*** the shell of a tortoise. **2** The outer covering of a fruit when the cover is very hard, *e.g.* the shell of a nut. ↓ UNIVALVE · EPICUTICLE ↑ SKIN → CUTICLE[2]

CF062 univalve (*n.*) A shell consisting of one whole piece, called a valve, *e.g.* snails (*Gastropoda*) possess a univalve shell. —UNIVALVE (*adj.*) ↓ BIVALVE · CONCHIOLIN ↑ SHELL[1]

CF063 bivalve (*n.*) A shell consisting of two valves, or plates, joined by a ligament, *e.g.* as in lamellibranchs and brachiopods. —BIVALVE (*adj.*) ↑ UNIVALVE

CF064 conchiolin (*n.*) A chitinous, calcareous substance forming the shell of molluscs. ↑ UNIVALVE

CF065 epicuticle (*n.*) The waxy, outermost layer of the cuticle of insects; it makes the cuticle impermeable to water. ↓ HYPODERMIS[1] · CUTICULIN ↑ SHELL[1]

CF066 hypodermis[1] (*n.*) (In invertebrates) a layer of cells underneath a cuticle, secreting the substance which forms the cuticle. —HYPODERMAL (*adj.*) ↑ EPICUTICLE → EPIDERMIS[2] · EPIDERMIS[2] (Cn)

CF067 cuticulin (*n.*) A substance formed from protein and a fatty compound; it forms the epicuticle of insects. ↑ EPICUTICLE

CF068 wing[1] (*n.*) **1** The modified fore limb of a bird; it consists of a pentadactyl limb covered in feathers. **2** The modified forelimb of some mammals, *e.g.* bats; it consists of a membrane joining the digits of a pentadactyl limb. **3** A membrane structure borne on the thorax of an insect; the membrane is stiffened by nervures. **4** A broad expansion, sometimes membranous, sometimes stiff and thin, *e.g.* the wing of a bone or the wing of a seed with a structure resembling a wing in appearance and/or function. —***winged, wingless*** (*adj.*) ↓ NERVURE · BASTARD WING · PTERYGOTOUS ↑ SKIN → PENTADACTYL LIMB

CF069 nervure (*n.*) A stiff, rib-like structure, providing mechanical support for the membranous wing of an insect; it is a branch of the tracheal system. ↓ NERVURATION · HALTERES · BALANCER ↑ WING → TRACHEAL SYSTEM

CF070 nervuration (*n.*) The pattern or arrangement of nervures in an insect's wings. ↑ NERVURE

CF071 halteres (*n.pl.*) The rudimentary hind wings of dipteran insects, consisting of small, knobbed projections from the body. Their function is sensory; it is thought they help to maintain equilibrium in flight. ↑ NERVURE

CF072 balancer (*n.*) Alternative term for HALTERE (see HALTERES). ↑ NERVURE

CF073 bastard wing (*n.*) That part of a bird's wing formed by the first digit (the

equivalent of a thumb); it bears three or four short feathers and plays an important part in the flight of some birds. ↑ WING

CF074 pterygotous (*adj.*) Having wings; winged. ↓ PTERYGOID · APTERYGIAL · HYMENOPTEROUS · APTEROUS ↑ WING

CF075 pterygoid (*adj.*) Winglike. ↑ PTERYGOTOUS

CF076 apterygial (*adj.*) Wingless; without fins or limbs. ↓ APTEROUS ↑ PTERYGOTOUS

CF077 hymenopterous (*adj.*) (Of insects) having thin membranous wings, *e.g.* the wasps and bees belonging to the order *Hymenoptera*. ↑ PTERYGOTOUS

CF078 apterous (*adj.*) Wingless and never growing wings; the term is more common than apterygial when used to mean wingless. ↑ PTERYGOTOUS

CF079 feather (*n.*) (In birds) an outgrowth of the skin, able to be moved by muscles in the same way as hair; feathers consist of keratinized dead cells, as does hair. Birds moult their feathers once a year. Each feather consists of a shaft and barbs; different arrangements give rise to the three different types of feather; contour feathers, down feathers and filoplumes. —FEATHERED, ***feathery*** (*adj.*) ↓ QUILL · CONTOUR FEATHER · PREEN GLAND · PREEN · FEATHERED ↑ SKIN

CF080 quill (*n.*) **1** The hollow portion of the shaft of a feather, most of which is embedded in a small pit in the skin (a follicle). The quill has two minute openings, a superior umbilicus where the quill perforates the skin, and an inferior umbilicus at the base of the quill. **2** The whole shaft of a quill feather, *i.e.* the quill and the rachis. **3** One of the hollow spines on a porcupine; they can be ejected by the animal. ↓ RACHIS[2] · VANE · BARB[2] · BARBULE · VEXILLUM · BARBICEL ↑ FEATHER

CF081 rachis[2] (*n.*) The solid part of the shaft above the quill of a contour feather; it bears barbs. ↑ QUILL

CF082 vane (*n.*) The wide flat surface of a contour feather, consisting of barbs joined by barbules. ↑ QUILL

CF083 barb[2] (*n.*) A delicate threadlike structure borne obliquely on the shaft of a contour feather, borne in tufts on a filoplume, and borne separately on a down feather. A barb is free when not joined by barbules to other barbs. ↑ QUILL

CF084 barbule (*n.*) A small, hooked process on a barb; the hooks on the barbules of one barb interlock with the hooks of the barbules on another barb, keeping the barbs together. Free barbs do not possess barbules. ↑ QUILL

CF085 vexillum (*n.*) Alternative term for the VANE of a feather. ↑ QUILL

CF086 barbicel (*n.*) A small process on the barbule of a feather. ↑ QUILL

CF087 contour feather (*n.*) Large feathers which cover the body, wings, and tail of a bird and give the body its shape; they consist of a vane and a shaft. Contour feathers are restricted to certain areas of the skin; because the feathers overlap they cover the bird's body. ↓ PLUMA · QUILL FEATHER · COVERT · DOWN FEATHER · FILOPLUME · PLUMAGE ↑ FEATHER

CF088 pluma (*n., pl.* **plumae**) Alternative term for a CONTOUR FEATHER (↑).

CF089 quill feather (*n.*) A contour feather borne on the wings or tail; quill feathers are used in flying. ↑ CONTOUR FEATHER

CF090 covert (*n.*) A contour feather borne on the body. ↑ CONTOUR FEATHER

CF091 down feather (*n.*) A small soft feather with free barbs on a short shaft. In adult birds they are beneath the contour feathers and cover the body; in young chicks they are the only feathers and cover the entire body. Down feathers insulate the body against cold by trapping a layer of air against the skin. ↑ CONTOUR FEATHER

CF092 filoplume (*n.*) A small, delicate, hairlike feather with a tuft of a few free barbs at the end of a long shaft. Such feathers are found between the contour feathers on the body of a bird; they are more difficult to pull out than other feathers. ↑ CONTOUR FEATHER

CF093 plumage (*n.*) The distinctive colour and arrangement of feathers on a bird. ↑ CONTOUR FEATHER

CF094 preen gland (*n.*) An oil gland situated on the hump at the posterior end of a bird's body (its uropygium). ↓ UROPYGIAL GLAND ↑ FEATHER

CF095 uropygial gland (*n.*) Alternative term for PREEN GLAND.

CF096 preen (*v.t.*) (Of a bird) to smooth the contour feathers with its beak, at the same time applying oil from an oil gland (the preen gland). ↓ RUFFLE ↑ FEATHER

CF097 ruffle (*v.t.*) (Of a bird) to disturb contour feathers by erecting them in succession so as to rearrange the feathers and afterwards return them to their position of rest. ↑ PREEN

CF098 feathered (*adj.*) Bearing feathers. ↓ FEATHERY ↑ FEATHER

CF099 feathery (*adj.*) Resembling a feather in shape or structure. ↑ FEATHERED

CF100 cauda (*n.*) **1** A tail, or a tail-like structure. **2** The posterior part of an organ. —CAUDAL, CAUDATE (*adj.*) ↓ FIN · UROPYGIUM · HOMOCERCAL ↑ SKIN → CAUDAL

CF101 fin (*n.*) (In aquatic vertebrates) a fold of skin with skeletal support, forming a thin flat surface and projecting from the body. Fins may be paired or unpaired, separate or continuous. All fishes, except *Agnatha*, have fins. The function of a fin is to control direction of movement and equilibrium. ↓ RAY[2] · FLUKE[1] ↑ CAUDA

CF102 median fin (*n.*) An unpaired continuous fin along the mid-line of the dorsal side of a fish. ↑ FIN

CF103 dorsal fin (*n.*) An unpaired separate fin situated on the mid-line of the dorsal side of the fish; the length of the fin can vary, but it is not continuous along the whole of the mid-line. ↑ FIN

CF104 caudal fin (*n.*) An unpaired fin on the tail of a fish. ↑ FIN

CF105 ventral fin (*n.*) An unpaired, separate fin on the mid-line of the ventral side of a fish. ↑ FIN

CF106 pectoral fin (*n.*) One of paired lateral fins attached to the pectoral girdle of a fish. ↑ FIN

CF107 pelvic fin (*n.*) One of paired lateral fins attached to the pelvic girdle of a fish. ↑ FIN

CF108 ray[2] (*n.*) A bony or cartilaginous spine supporting the fin of a fish. ↑ FIN

CF109 fluke[1] (*n.*) A triangular division of a tail, when the tail is split into parts. ↑ FIN

CF110 uropygium (*n.*) The hump at the caudal end of a bird; it contains caudal vertebrae and supports the tail feathers. —***uropygial*** (*adj.*) ↓ PODEX ↑ CAUDA

CF111 podex (*n.*) The region of the body round the anus. —***podical*** (*adj.*) ↑ UROPYGIUM

CF112 homocercal (*adj.*) Describes a caudal fin with two equal or nearly equal lobes; the backbone ends at the point of division of the lobes, in the middle of the fin. ↓ HETEROCERCAL (An) ↑ CAUDA

CF113 heterocercal (*adj.*) Describes a caudal fin in which the backbone is continued into the upper and larger lobe of the fin. ↑ HOMOCERCAL (An)

CF114 caudate (*adj.*) Describes an organism or a structure with a tail. ↑ HOMOCERCAL

CF115 tentacle (*n.*) (In invertebrates) a slender, flexible structure borne on the head; it is used for feeling, attachment, gripping prey, and occasionally for swimming and breathing. A tentacle is not jointed; an animal usually has several tentacles, rather than a single tentacle, *e.g.* an octopus has eight tentacles. —***tentacular*** (*adj.*) ↓ TENTACULUM · CERCUS · SPINNING GLAND ↑ SKIN

CF116 tentaculum (*n.*) Alternative term for TENTACLE. ↓ ANTENNA[1] · ANTENNULE · CERCUS · STYLE[2] · SWIMMERET ↑ TENTACLE

CF117 antenna[1] (*n., pl.* **antennae**) (In insects and myriapods) the first appendage on the head; (in crustaceans) the second appendage on the head. Antennae are always paired, usually much jointed and flexible, and wave about in the air. They vary considerably from being club-shaped to being feathery. Their function is mainly sensory (for touch and smell), but in some crustaceans they may be used to propel the animal through the water. —***antennary*** (*adj.*) ↑ TENTACULUM

CF118 antennule (*n.*) (In crustaceans) the first appendage on the head. Antennules are paired and are usually sensory in function. ↑ TENTACULUM

CF119 cercus (*n., pl.* **cerci**) A jointed appendage at the posterior end of the abdomen in many arthropods; in some insects it bears acoustic hairs. Cerci are always paired. In earwigs, the cerci are modified to form pincers. Also called ***anal cerci.*** ↑ TENTACULUM → ANAL CERCI (Sn)

CF120 style[2] (*n.*) A bristle-like structure on the abdomen of insects. ↑ TENTACULUM

CF121 swimmeret (*n.*) (In crustaceans) one of a number of paired abdominal appendages; they are used partly for swimming, but chiefly for gripping eggs. ↑ TENTACULUM

CF122 spinning gland (*n.*) (In spiders and caterpillars) a gland secreting liquid silk; the dried product is used in spiders' webs and the cocoons of caterpillars. ↓ SPINNERET ↑ TENTACLE

CF123 spinneret (*n.*) (In spiders) one of the 4 to 6 organs perforated by ducts leading from the spinning glands. ↑ SPINNING GLAND

Anatomical Terms

CG001 anatomical terms (*n.pl.*) **1** (Of animals) terms describing the location and spatial relationships of parts of the body. An animal is assumed to be in its normal standing or floating position, and the terms relate to this posture only. **2** (Of plants) similar terms are used; a plant is assumed to be growing in an upright position, with root and stem vertical. Many terms occur in the section **Plant Morphology**, as they deal with external form rather than internal structure. **3** Some terms, describing spatial disposition, apply to both plants and animals. All terms may be altered from adjectives to adverbs by altering the suffix *-al* to *-ad*, *e.g.* *ventral* becomes *ventrad*, and means *in a ventral direction.* Adverbs are more commonly formed by adding the suffix *-ly*, *e.g.* *ventrally.* ↓ ANTERIOR · POSTERIOR · DORSAL · DISTAL · INTERNAL · PERIPHERY · SYMMETRY · STRUCTURE[2] → REGION[2] · LINK[1] · PARTITION[1] · SURFACE[2] · COAT · CAVITY · OSTEOLOGY · ANATOMY · PLANT · VASCULAR PLANT · METAZOA · SKELETON

CG002 anterior (*adj.*) Nearer to the head end of an animal, *e.g.* the stomach is at the anterior end of the alimentary canal □ *the most anterior segment of bone in the head is small; anteriorly, the frontals become fine processes; the neck is anterior to the thorax* ↓ SUPERIOR (Sn) · CEPHALIC (Sn) · CRANIAL (Sn) · POSTERIOR (Ag) ↑ ANATOMICAL TERMS

CG003 superior (*adj.*) A term used in place of anterior when describing anatomical structures in man and other mammalian bipeds; the normal posture places the head above the other parts of the body, and not in front, as in quadrupeds, *e.g.* the superior

carval veins in man are equivalent to the anterior carval veins in quadrupeds. ↓ CEPHALIC (Sn) · CRANIAL (Sn) · INFERIOR (Ag) ↑ ANTERIOR (Sn) → BIPED · QUADRUPED

CG004 cephalic (*adj.*) Alternative term for ANTERIOR(↑). The term is preferred in descriptions of the structure of embryos.

CG005 cranial (*adj.*) **1** Alternative term for ANTERIOR. **2** Of or to do with the cranium. ↑ ANTERIOR → CRANIUM

CG006 posterior (*adj.*) Nearer to the tail end of the animal, *e.g.* the anus is at the posterior end of the alimentary canal □ *the urinary bladder is in the most posterior part of the peritoneal cavity; the bone fuses posteriorly with the occipital segment; the thorax is posterior to the neck* ↓ INFERIOR (Sn) · CAUDAL (Sn) · ANTEROPOSTERIOR ↑ ANATOMICAL TERMS → PERITONEAL CAVITY · OCCIPITAL · ANTERIOR (Ag)

CG007 inferior (*adj.*) A term used in place of posterior when describing structures in man and other mammalian bipeds, *e.g.* the inferior vena cava in man is equivalent to the posterior vena cava in quadrupeds. ↓ CAUDAL (Sn) ↑ POSTERIOR (Sn) · SUPERIOR (Ag)

CG008 caudal (*adj.*) **1** Of or to do with the tail of an animal, *e.g.* ***a*** caudal vertebrae are those in the tail; ***b*** the caudal fin is an alternative term for a fish's tail. **2** An alternative term for POSTERIOR; it is preferred in descriptions of the structure of embryos. ↑ POSTERIOR

CG009 anteroposterior (*adj.*) Describes a structure which stretches from the anterior end to the posterior end of an animal, or lies in that direction. ↑ POSTERIOR

CG010 dorsal (*adj.*) At, near, or lying nearer to, the back of an animal, *e.g.* ***a*** the dorsal surface is the surface on the back of the animal; ***b*** the dorsal surface of a kidney is the surface nearer to the back of the animal, when the kidney is in its normal position in the body. In man, the dorsal surface is sometimes called the posterior surface □ *the nerve originates from the dorsal surface of the spinal cord; the oesophagus is dorsal to the trachea; the tubular heart of an insect is situated dorsally* ↓ VENTRAL (Ag) · LATERAL · DORSOVENTRAL · DORSIVENTRAL ↑ ANATOMICAL TERMS

CG011 ventral (*adj.*) At, near, or lying nearer to the lower or abdominal surface of an animal, *e.g.* the ventral surface is the surface on the underside of a quadruped. In man, the ventral surface is the front surface and is sometimes called the anterior surface, *e.g.* the ventral surface of an animal includes the chest and the abdominal surface; the ventral surface of a kidney is further away from the back than the dorsal surface □ *the nerve originates from the ventral surface of the medulla; the trachea is ventral to the oesophagus* ↑ DORSAL (Ag)

CG012 lateral (*adj.*) Situated at a side or away from the median plane, *e.g.* the lateral line of a fish. Contrast **peripheral** with lateral: the peripheral nerves cover all body surfaces, *i.e.* dorsal, ventral, and lateral; the lateral line system is situated on both sides of a fish. ↓ PERIPHERAL ↑ DORSAL · VENTRAL → MEDIAL (Ag)

CG013 dorsoventral (*adj.*) Describes a structure which stretches from the dorsal to the ventral side of an animal, or lies in that direction. ↑ DORSAL · VENTRAL

CG014 dorsiventral (*adj.*) Describes a structure, or an organism with upper and lower surfaces distinct from one another, *e.g.* many leaves with upper and lower surfaces structurally distinct from one another. ↑ DORSAL

CG015 distal (*adj.*) Describes a part farther from the point of attachment or origin, *e.g.* the hand is a distal part of the arm □ *the foot is the most distal part of the leg; the shin is distal to the knee; the knee is situated distally to the thigh* ↓ PROXIMAL (Ag) · TERMINAL[1] · PERIPHERAL · PARIETAL · HYPODERMIC · SUBCUTANEOUS · SUBDERMAL ↑ ANATOMICAL TERMS

CG016 proximal (*adj.*) (Of an appendage) describes a part nearer to the point of attachment or origin, *e.g.* the thigh is proximal □ *the thigh is the most proximal part of the leg; the knee is proximal to the shin; the thigh is situated proximally to the knee* ↑ DISTAL (Ag)

CG017 terminal[1] (*adj.*) Of, to do with, or situated at, the end of a structure, *e.g.* ***a*** the terminal bud is situated at the end of the stem; ***b*** the fingers are terminal structures of the arm. ↑ DISTAL

CG018 peripheral (*adj.*) Describes a part of an organism near the surface, *e.g.* the ectoplasm of a cell is peripheral protoplasm. ↑ DISTAL · LATERAL → MARGINAL (Sn) · ECTOPLASM · PROTOPLASM

CG019 parietal (*adj.*) Of, situated in, or forming, the wall of a structure, *e.g.* in parietal placentation, ovules are fused to the ovary walls. ↑ DISTAL → SEPTAL · VISCERAL (An)

CG020 hypodermic (*adj.*) Describes the parts or regions just under the skin. ↑ DISTAL → HYPODERMAL

CG021 subcutaneous (*adj.*) Under the skin or under the dermis. ↑ DISTAL

CG022 subdermal (*adj.*) Alternative term for SUBCUTANEOUS. ↑ DISTAL

CG023 internal (*adj.*) Lying inside the body, or the part of the body under consideration, *e.g.* the cortex and medulla are internal parts of the kidney. ↓ EXTERNAL (An) · ABAXIAL · ADAXIAL · COLLATERAL · PROSTRATE ↑ ANATOMICAL TERMS → PRONE · SUPINE

CG024 external (*adj.*) **1** Lying outside the body, or the part of the body under consideration, *e.g.* the adrenal gland is external to the kidney. **2** Situated outside the body, *e.g.* the external features of a mammal are observable features from outside the mammal □ *the auditory meatus is external to the middle ear* ↑ INTERNAL (An)

CG025 abaxial (*adj.*) Away from, or on the opposite side to, the axis of an organism, *e.g.*

the abaxial surface of a leaf. ↓ ADAXIAL (P) ↑ INTERNAL

CG026 adaxial (*adj.*) Turned towards or nearer to the axis of an organism. ↑ ABAXIAL (P) · INTERNAL

CG027 collateral (*adj.*) Side by side, *e.g.* ***a*** collateral bundles of xylem and phloem situated side by side in the same radius; ***b*** the collateral descent of two organisms from a common ancestor, but from different parents, grandparents, etc. ↑ INTERNAL → COLLATERAL BUNDLE · XYLEM · PHLOEM

CG028 prostrate (*adj.*) Alternative term for either PROCUMBENT OR PRONE. ↑ INTERNAL → PROCUMBENT · PRONE

CG029 periphery (*n.*) The outer surface or outer zone of a body or organism, *e.g.* the layer just under the skin of an animal is its periphery. —PERIPHERAL (*adj.*) ↑ ANATOMICAL TERMS

CG030 symmetry (*n.*) The state of having a regular form such that one or more axes exist which divide the structure into similar halves, *e.g.* a square exhibits symmetry as it can be divided into equal halves by axes through opposite corners or through the mid-points of opposite sides □ *a circle exhibits symmetry; a sphere has, or possesses, symmetry about any line drawn through its centre* ↓ RADIAL SYMMETRY · ASYMMETRY (An) · RADIAL PLANE · SECTION · RADIAL · EQUATORIAL ↑ ANATOMICAL TERMS

CG031 radial symmetry (*n.*) Symmetry in which an object, or organism, can be halved by any number of planes through its axis, to form two halves that are mirror images of each other, *e.g.* ***a*** a circle has radial symmetry, as it can be cut in two by any number of lines passing through its centre; ***b*** a cylinder has radial symmetry □ *a living organism possesses radial symmetry* ↓ BILATERAL SYMMETRY · MIDLINE · AXIS[2] · ASYMMETRY ↑ SYMMETRY

CG032 bilateral symmetry (*n.*) Symmetry in which an object or an organism can be halved by one plane only, so that the two halves are approximately mirror images of each other. All vertebrates possess bilateral symmetry as a plane can divide them into left and right halves; the plane lies dorsoventrally and anteroposteriorly. Most invertebrates, *e.g.* Arthropods, and many types of worms, also possess bilateral symmetry □ *a living organism possessing bilateral symmetry* ↑ RADIAL SYMMETRY

CG033 midline (*n.*) The line of the plane which divides an organism into bilaterally symmetrical halves. ↑ RADIAL SYMMETRY · BILATERAL SYMMETRY

CG034 axis[2] (*n., pl.* **axes**) **1** A line drawn through a structure to divide it into two balanced halves. **2** A line about which a body rotates or revolves. —AXIAL, AXILE (*adj.*) ↑ RADIAL SYMMETRY

CG035 asymmetry (*n.*) The state of having no regular form such that there are no axes which divide the structure into two halves which are balanced, *e.g.* an irregular shape exhibits asymmetry. ↑ RADIAL SYMMETRY

CG036 radial plane (*n.*) In radially symmetrical organisms, a plane passing through the axis of the body and dividing it into two symmetrical halves. See RADIAL SYMMETRY. ↓ MEDIAN PLANE · CORONAL PLANE · LONGITUDINAL PLANE · TRANSVERSE PLANE · TANGENTIAL PLANE · OBLIQUE PLANE · SAGITTAL PLANE ↑ SYMMETRY

CG037 median plane (*n.*) (In animals) a vertical plane passing through the axis of the body and dividing it into symmetrical right and left portions. ↑ RADIAL PLANE

CG038 coronal plane (*n.*) (In animals) a plane passing through the axis of the body, at right angles to the median plane; it divides the body of bilaterally symmetrical organisms into dorsal and ventral portions; radially symmetrical organisms do not possess coronal planes. ↑ RADIAL PLANE · AXIS[2] · BILATERAL SYMMETRY · RADIAL SYMMETRY → DORSAL · VENTRAL

CG039 longitudinal plane (*n.*) (In plants) a vertical plane passing through the axis of stem and root, or from base to apex of any side structure, such as a leaf. ↑ RADIAL PLANE

CG040 transverse plane (*n.*) **1** (In bilaterally symmetrical animals) a plane at right angles to both the median and the coronal planes; it divides the body into cranial and caudal portions. **2** (In radially symmetrical organisms) a plane at right angles to any radial plane or to a longitudinal plane; it divides the organism into two symmetrical halves. ↑ RADIAL PLANE · MEDIAN PLANE · CORONAL PLANE · LONGITUDINAL PLANE → CRANIAL · CAUDAL

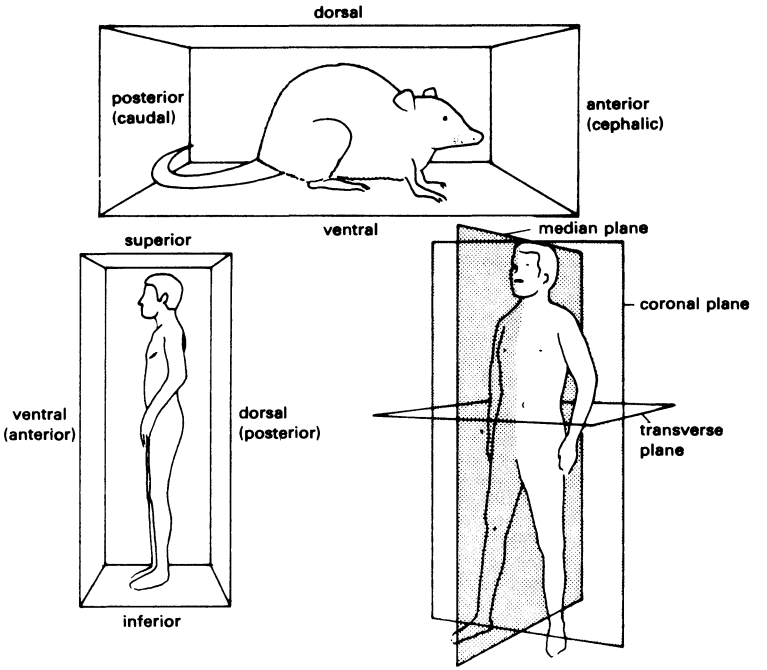
CG041 tangential plane (*n.*) A plane parallel to a longitudinal plane not passing through an axis of symmetry of a body; it cuts the body into two unequal parts. ↑ RADIAL PLANE · LONGITUDINAL PLANE

CG042 oblique plane (*n.*) A plane passing through the intersection of a longitudinal plane and a transverse plane, and inclined at an angle to both of these planes, usually at a different angle to each plane. ↑ RADIAL PLANE

CG043 saggital plane (*n.*) A plane parallel to the median plane of a structure. ↑ RADIAL PLANE

CG044 section (*n.*) A cut made through the body of an organism exposing two surfaces. In animals, main sections are cut in, or parallel to, the three main planes: median, coronal, and transverse. Similar sections, (*i.e.* median, coronal, or transverse), can be cut through any organ, *e.g.* the heart, lungs or kidneys, the planes always relating to the natural position of the organ. In plants, sections are cut parallel to a longitudinal plane (a longitudinal section) or to a transverse plane (a transverse section). ↑ SYMMETRY · MEDIAN PLANE · CORONAL PLANE · TRANSVERSE PLANE

CG045 radial (*adj.*) Of or to do with a radius of a circle. ↓ BILATERAL · MEDIAL · MEDIAN · SAGGITAL · LONGITUDINAL · TRANSVERSE · AXILE · AXIAL · SYMMETRICAL · ASYMMETRICAL ↑ SYMMETRY



MEDIAN, CORONAL, AND TRANSVERSE PLANES

CG046 bilateral (*adj.*) Describes a structure which has two sides, (usually called left and right), symmetrically placed about an axis. ↑ RADIAL

CG047 medial (*adj.*) Any position in, near to, or nearer to, the median plane. ↑ RADIAL → LATERAL (Ag)

CG048 median (*adj.*) Describes a position in an axial plane of symmetry; usually describes an axial plane in bilateral symmetry. ↑ RADIAL

CG049 saggital (*adj.*) Describes the median plane or any plane parallel to the median plane, or any section cut in such a plane. ↑ RADIAL · SECTION · MEDIAN

CG050 longitudinal (*adj.*) In the direction of the longest axis or the length of a structure, *e.g.* a plane down the stem of a plant is a longitudinal plane. ↑ RADIAL · LONGITUDINAL PLANE

CG051 transverse (*adj.*) Describes a direction perpendicular to a longitudinal direction, *i.e.* going from one side to the other side of a structure, *e.g.* a plane cutting across the stem of a plant, perpendicular to the axis of the plant, is a transverse plane. ↑ RADIAL

CG052 axile (*adj.*) Situated in or on an axis, *e.g.* axile placentation in which ovules are situated on axes of an ovary. ↑ RADIAL · AXIS[2] → OVULE · OVARY[2]

CG053 axial (*adj.*) Of, to do with, or in the direction of, an axis or a plant stem, *e.g.* the axial skeleton is the skeleton forming the axis of a vertebrate body. ↑ RADIAL

CG054 symmetrical (*adj.*) Describes a structure which has an axis of symmetry, *i.e.* a structure which exhibits symmetry, *e.g.* a circle is symmetrical about any line drawn through its centre. □ *a square is symmetrical about a line drawn from one corner to the opposite corner* ↓ ASYMMETRICAL (An) ↑ RADIAL (An)

CG055 asymmetrical (*adj.*) Describes any structure exhibiting asymmetry. ↑ RADIAL · SYMMETRICAL (An)

CG056 equatorial (*adj.*) **1** Describes a plane passing through the centre of a sphere, or through the widest part of a regular curved figure, such as a spheroid, *e.g.* the plane perpendicular to the spindle of a dividing cell and midway between the poles. **2** Describes the line where the equatorial plane cuts the surface of such a figure. ↑ SYMMETRY

CG057 structure[2] (*n.*) A part of an organism which is a structural unit, but not necessarily a functional unit. The term is used to describe a unit or structural element to which a more specific description, *e.g.* vessel, cavity, appendage, cannot be given. ↓ OUTGROWTH · PROTUBERANCE · TIP · PROTRUDE[1] · APICAL · ACUMINATE · SLENDER · SPHERE · RADIUS[2] · ROD[1] · GLOBE · RADIATE[1] · FUSIFORM · GLOBULAR · SPINDLE-SHAPED · MEMBRANE · FILAMENT[1] · MEMBRANOUS · CONVOLUTED · IMPERVIOUS[3] ↑ ANATOMICAL TERMS → ANTHERIDIUM · ARCHEGONIUM · PROTHALLUS

CG058 outgrowth (*n.*) A part that grows or develops outwards from a main part, *e.g.* the peripheral nervous system originates from a series of paired outgrowths of the spinal cord of an embryo. An outgrowth can be a process, projection, or protuberance, such as cilia or flagella. ↓ INGROWTH · PROCESS[3] (H) · DIVERTICULUM · CORPUSCLE · FRINGE[1] · PROTUBERANCE (H) · PROJECTION (H) ↑ STRUCTURE[2] → EVAGINATE

CG059 ingrowth (*n.*) A part that grows or develops inwards into a main part, *e.g.* ingrowths which develop into the nares. ↑ OUTGROWTH → INVAGINATE

CG060 process[3] (*n.*) An outgrowth from a main part under consideration, *e.g.* processes from a cell are small outgrowths from the cell body. ↑ OUTGROWTH

CG061 diverticulum (*n., pl.* **diverticula**) A blind-ending tubular or sac-like outgrowth from a cavity, such as the ventricle of the brain. ↑ OUTGROWTH → VENTRICLE[2]

CG062 corpuscle (*n.*) **1** A minute particle which is part of a cell. **2** A small multicellular structure, *e.g.* a tactile corpuscle. **3** A protoplasmic cell floating freely in a body fluid, *e.g.* a red blood corpuscle. **4** A protoplasmic cell embedded in a matrix. —***corpuscular*** (*adj.*) ↑ OUTGROWTH

CG063 fringe[1] (*n.*) A border or edge formed of hairs, or hair-like structures, *e.g.* a fringe of cilia around an opening or around the mouth of some invertebrates. —***fringed*** (*adj.*) ↑ OUTGROWTH → CILIA · ORIFICE

CG064 protuberance (*n.*) A rounded projection, more rounded than a convexity. —***protuberancy*** (*n.*) ***protuberant*** (*adj.*) ↓ KNOB · RIDGE · EMINENCE · UMBO · PROJECTION · PAPILLA[1] · NODULE[1] ↑ STRUCTURE[2] → CONVEXITY

CG065 knob (*n.*) A spherical protuberance, especially when situated at the end of a long structure. —***knobbly*** (*adj.*) ↑ PROTUBERANCE

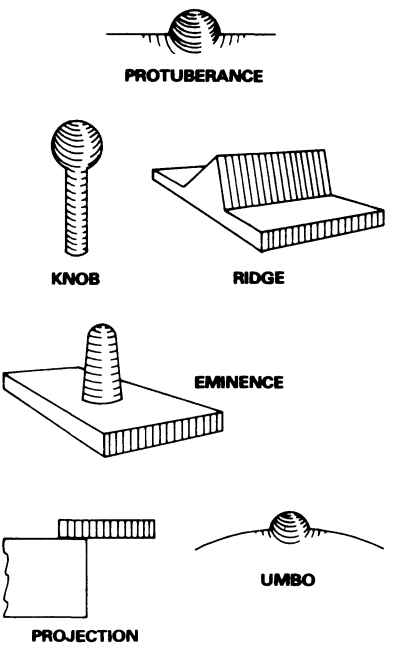
CG066 ridge (*n.*) The line where two sloping surfaces meet; a long, narrow, pointed projection from the surface of a solid, *e.g.* ***a*** the long, narrow top of a hill; ***b*** the ridge of earth pushed up by a plough □ *a high ridge of land situated between two valleys; a low ridge of earth* —***ridged*** (*adj.*) ↑ PROTUBERANCE → SPINE · GROOVE (Cn) · WAVE CREST (Sn)

CG067 eminence (*n.*) A rounded projection rising above the surrounding surface. ↑ PROTUBERANCE

CG068 umbo (*n., pl.* **umbones**) **1** A protuberance at, or near the centre, or at the middle of, a convex surface. **2** The oldest part of a bivalve shell. ↑ PROTUBERANCE

CG069 projection (*n.*) A structure that projects from the surface or from the body of a larger structure; it is a general term which does not describe any particular shape. ↑ PROTUBERANCE

CG070 papilla[1] (*n., pl.* **papillae**) A small projection, *e.g.* ***a*** the projections on the upper surface of the tongue (lingual papillae); ***b*** mammary papillae with a duct



for the flow of milk. ↑ PROTUBERANCE

CG071 nodule[1] (*n.*) A small, knob-like outgrowth from a surface, *e.g.* ***a*** nodules in smallpox; ***b*** lymph nodules in lymphatics. —***nodulation*** (*n.*) NODULIFEROUS (*adj.*) ↑ PROTUBERANCE · KNOB · OUTGROWTH → NODULE[2] · LYMPH · LYMPHATIC[2]

CG072 tip (*n.*) The surface at the end of a structure, *e.g.* the tip of the finger, the tip of the nose. A tip may be rounded, blunt, pointed or sharp. To contrast **end** with **tip**: A nail grows at the end of a finger (end implies a region); the nail grows past the tip of the finger if it is not cut short. ↓ APEX · BASE[1] · RADIX · RAY[1] · CORONA ↑ STRUCTURE[2]

CG073 apex (*n., pl.* **apices**) The uppermost, or less commonly the lowermost, tip of a structure; the term implies that the tip is pointed to some degree, *e.g.* ***a*** the apex of the heart is the lowest pointed tip; ***b*** the apex of the lung is the upper pointed tip; ***c*** the apex of a stem is the uppermost pointed tip. —APICAL (*adj.*) ↓ BASE[1] (An) ↑ TIP

CG074 base[1] (*n.*) The opposite end of a structure to the apex; the term usually implies a lower end which gives support to the structure, *e.g.* the base of the skull is the lower part, and it supports the remainder of the skull and contents. —BASAL, BASIC (*adj.*) ↑ TIP · APEX (An)

CG075 radix (*n., pl.* **radices, radixes**) The root or point of origin of a structure, *e.g.* the radix of the aorta. To contrast **base** and **radix**: the base of the stem (a base provides support for the stem); the radix, or root, of a nerve (the nerve comes into being at the

root, and is connected functionally with the root; no support is given). ↑ TIP → ROOT · AORTA

CG076 ray[1] (*n.*) Any one of a number of lines originating from a common centre. ↑ TIP

CG077 corona (*n.*) **1** The uppermost part of a structure. **2** A disc or circular band at the anterior end of an animal. ↑ TIP

CG078 protrude[1] (*v.i.*) To be further out from a base on the body of an organism than is considered to be normal, *e.g.* ***a*** his eyes protrude (his eyes project outwards, or bulge more than normal eyes); ***b*** the abdomen of a pregnant woman protrudes (the abdomen projects outwards more than when the woman is not pregnant). —***protrusive*** (*adj.*) ↓ TAPER · FLARE ↑ STRUCTURE[2] → FLICK · LASH · PROTRACTILE

CG079 taper (*v.i.*) **1** (Of a structure) to decrease gradually in girth, usually decreasing to a point. **2** (Of an amount or process) to decrease gradually. —***tapered*** (*adj.*) ↓ FLARE (An) ↑ PROTRUDE[1]

CG080 flare (*v.i.*) (Of a structure) to increase gradually in girth or breadth; the focus is on the increasing girth or breadth. ↑ PROTRUDE[1] · TAPER (An)

CG081 apical (*adj.*) At or in the region of the apex of a plant. ↓ BASAL · REFLEX · CORONARY · CORONAL ↑ STRUCTURE[2] · APEX

CG082 basal (*adj.*) Of or to do with the base of a structure; the focus is on position. ↑ APICAL · BASE[1] → BASIC[1]

CG083 reflex (*adj.*) (Of a structure) turned back on itself; bent in that manner, *e.g.* a reflex arc in which a stimulus, such as a hot object, sends impulses along a nervous path, with impulses returning to an effector so that, for example, a hand is removed from the hot object. ↑ APICAL

CG084 coronary (*adj.*) Crown-shaped; forming a circle round a structure, *e.g.* coronary arteries supplying heart tissue encircle the heart. —***corona*** (*n.*) ↑ APICAL

CG085 coronal (*adj.*) Of or to do with the top of the head, or the upper part of any structure. ↑ APICAL

CG086 acuminate (*adj.*) Describes a structure tapering to a point. ↓ NODULIFEROUS · ERECT[1] · PENDENT · PENDULOUS · SQUAT[1] ↑ STRUCTURE[2] · TAPER

CG087 noduliferous (*adj.*) Describes a structure bearing nodules. ↑ ACUMINATE · NODULE[1]

CG088 erect[1] (*adj.*) Standing upright in position or posture. —***erector*** (*n.*) ERECT (*v.*) ↑ ACUMINATE → PROCUMBENT (An) · CAULINE · ETIOLATED · STEM

CG089 pendent (*adj.*) Describes a structure which hangs down, *e.g.* ***a*** pendent flowers from a peduncle; ***b*** pendent leaves from a branch. ↑ ACUMINATE · ERECT[1] (Cn) → PEDUNCLE

CG090 pendulous (*adj.*) Describes a structure which bends down and is capable of movement from side to side, *e.g.* ***a*** the pendulous branches of trees, especially when laden with fruit; ***b*** pendulous mammae on an old mammal. ↑ ACUMINATE · ERECT[1] (Cn) → MAMMA

CG091 squat[1] (*adj.*) Resembling a squatting biped in shape; the focus is on shortness compared with normal height for girth. ↑ ACUMINATE → GIRTH

CG092 slender (*adj.*) Of small girth. —***slenderness*** (*n.*) ↓ STOUT (Ag) · MINUTE · DELICATE · CAPILLARY[1] · MEDIUM[1] · ROBUST · TOUGH · FAT[3] ↑ STRUCTURE[2]

CG093 stout (*adj.*) Of large girth. —***stoutness*** (*n.*) ↑ SLENDER (Ag)

CG094 minute (*adj.*) Very small; only just able to be observed. ↑ SLENDER

CG095 delicate (*adj.*) **1** (Of a structure) thin or fine, and easily broken or ruptured. **2** (Of an organism) likely to die under adverse conditions; not strong and healthy. —***delicateness*** (*n.*) ↓ ROBUST (An) · TOUGH (An) ↑ SLENDER

CG096 capillary[1] (*adj.*) Describes a tube or vessel which has a very small diameter or bore; hair-like. —CAPILLARY (*n.*) ↑ SLENDER

CG097 medium[3] (*adj.*) Of middle size or quality, *i.e.* in the middle of a range of greater and smaller sizes and qualities, *e.g.* ***a*** a fish of medium length (there are as many fish which are longer as there are fish which are shorter); ***b*** a skin of medium thickness (in the middle of the range of thickness). ↑ SLENDER

CG098 robust (*adj.*) **1** (Of a structure) thick and strong; not easily broken or ruptured; not easily distorted. **2** (Of an organism) likely to live under adverse conditions; strong and healthy. ↑ SLENDER · DELICATE (An) → ADVERSE

CG099 tough (*adj.*) **1** (Of a structure) not easily ruptured or torn although able to be distorted; not easily worn out. **2** (Of food) difficult to masticate. ↑ SLENDER · DELICATE (An) → MASTICATE

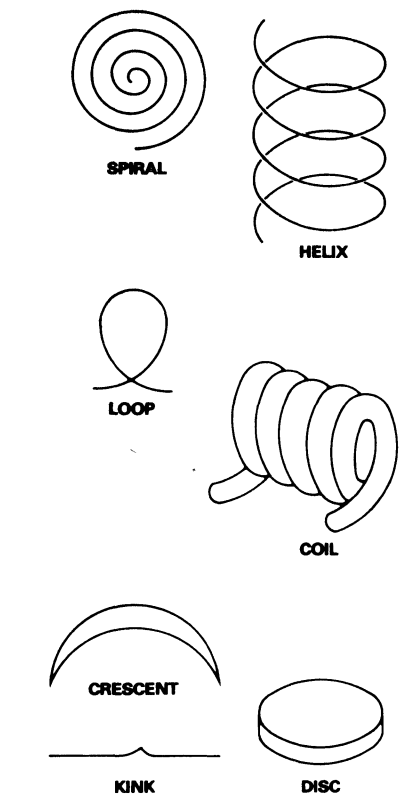
CG100 fat[3] (*adj.*) Alternative term for STOUT; the focus is on the deposition of subcutaneous adipose tissue (**fat**) causing the stoutness. —***fat*** (*n.*) ↑ SLENDER · STOUT → FATTY · ADIPOSE TISSUE

CG101 sphere (*n.*) A shape whose surface is everywhere at the same distance from its centre, *e.g.* a ball is a sphere. A sphere is a specific geometric shape. —SPHERICAL (*adj.*) ↓ COIL[1] · SPIRAL · HELIX · LOOP[1] · CRESCENT · DISC · CONE[3] · KINK ↑ STRUCTURE[2]

CF102 coil[1] (*n.*) A connected series of concentric rings, either of the same or of increasing radius □ *a coil of wire used in electrical experiments.* See next page. —***coiled*** (*adj.*) COIL (*v.*) ↓ RADIUS ↑ SPHERE → CONCENTRIC

CG103 spiral (*n.*) A flat structure in the shape of a line starting at a point, and curving with a regularly increasing radius, to form a series of concentric turns. The term is often used to describe a helix. See next page. —SPIRAL (*adj.*) ↑ SPHERE

CG104 helix (*n., pl.* **helices**) A connected series of concentric rings of the same radius, joined together to form a cylindrical shape See next page. ↑ SPHERE → CYLINDER



CG105 loop[1] (*n.*) A shape formed by a line, a rope, a thread or any other thin structure, in which the line forms a curved shape and turns back and crosses itself, *e.g.* a loop made in a piece of string when tying a knot. —***looped*** (*adj.*) ↑ SPHERE

CG106 crescent (*n.*) A shape like that of a new moon, *i.e.* pointed at both ends with one side convex and the other side concave. ↑ SPHERE

CG107 disc (*n.*) A round, flat, thin object. —DISCOID, DISCOIDAL (*adj.*) ↑ SPHERE

CG108 cone[3] (*n.*) A shape which is circular at the base and rises to a point at the top. A cone is a specific geometric shape. —***conical*** (*adj.*) ↑ SPHERE

CG109 kink (*n.*) An irregular twist interrupting the direction of a line, rope, thread, or tube; the twist may be a distortion or a deformation. In a tube or pipe the kink may interfere with the conduction of fluids. —***kinky*** (*adj.*) ↑ SPHERE

CG110 radius[2] (*n.*) **1** A straight line drawn from the centre of a circle to its circumference, or from the centre of a sphere to its surface. **2** The measurement of a line forming a radius, *e.g.* the radius of the circle is 5 cm. ↓ DIAMETER · GIRTH · CIRCUMFERENCE ↑ STRUCTURE[2]

CG111 diameter (*n.*) **1** A line drawn through the centre of a circle ending on the circumference at either end, or a line drawn through the centre of a sphere and ending on the surface at either end. **2** The measurement of the line drawn as a diameter; used as a measurement of the diameter of any circular structure, *e.g.* the diameter of a tube or a hair. To contrast **thickness** and **diameter**: thickness measures flat structures, *e.g.* the thickness of a membrane, or of a layer of tissue; diameter measures circular structures, *e.g.* the diameter of an artery. —***diametrical*** (*adj.*) ↑ RADIUS[2]

CG112 girth (*n.*) The distance around a long object; the circumference of a usually cylindrical long structure, *e.g.* ***a*** the girth of a man is the distance round his body; ***b*** the girth of a tree is the distance round its trunk. ↑ RADIUS[2]

CG113 circumference (*n.*) **1** The line which forms a circle; every point on the line is at the same distance from the centre of the circle. **2** The line which is the limit of any area, *e.g.* a square, an oblong or an irregular shape. **3** The length of line which is the circumference of any area. ↑ RADIUS[2]

CG114 rod[1] (*n.*) A straight, usually round object or structure, but it can also be square, octagonal, etc. and can be rigid or flexible. —***rod-like*** (*adj.*) ↓ COLUMN[1] · SHAFT · COLLAR · GIRDLE[1] ↑ STRUCTURE[2]

CG115 column[1] (*n.*) A tall, upright, rigid structure of approximately equal girth along its length, usually composed of a mass of substance, or of separate units one above the other, *e.g.* ***a*** the vertebrae in the backbone form a column of bones; ***b*** the stalk of some echinoderms is a column formed throughout of similar tissue; ***c*** figures placed one below the other form a column of figures. —COLUMNAR (*adj.*) ↑ ROD[1] · GIRTH → VERTEBRA · ECHINODERMATA

CG116 shaft (*n.*) The long, rod-like part of any structure which supports the head or functional part of the structure, *e.g.* ***a*** the shaft of a long bone is its straight, cylindrical part, supporting the articulating head of the bone; ***b*** the shaft of a hair is the part of a hair in a hair follicle. ↑ ROD[1] → HAIR FOLLICLE

CG117 collar (*n.*) **1** (G.S.) A piece of a garment worn round the neck. **2** Any small structure like a collar which encircles a rod-like or hair-like structure, *e.g.* ***a*** the join between root and stem of a plant, sometimes marked by a prominence; ***b*** the ridge at the junction of the lamina and leaf-sheath of a grass leaf is a collar which encircles the stem. ↑ ROD[1]

CG118 girdle[1] (*n.*) If an object or structure has a fairly large girth, then any band or other encircling structure is a girdle. A girdle is larger and stronger than a collar, *e.g.* the hip girdle of amniotes is a strong, encircling bony structure. ↑ ROD[1] · GIRTH → AMNIOTE

CG119 globe (*n.*) Spherical or nearly spherical body, *e.g.* a ball, or a ball flattened at the top and bottom. A globe may be hollow or solid throughout. —***globule*** (*n.*) GLOBULAR (*adj.*) ↓ GLOBULE · GLOMERATION ↑ STRUCTURE[2] · SPHERE (Sn)

CG120 globule (*n.*) A small globe, usually a small globe of liquid, *e.g.* a globule of oil on the surface of water. —***globular*** (*adj.*) ↑ GLOBE → DROP (Sn)

CG121 glomeration (*n.*) The act of forming a compact cluster, or a ball-shaped mass of objects. ↑ GLOBE

CG122 radiate[1] (*v.*) (Of lines or rays) to come out from a common point, like the radii of a circle originating from the centre, *e.g.* on a starfish, grooves radiate from the centre of the calcareous plate. ↑ STRUCTURE[2] → CONVERGE (An)

CG123 fusiform (*adj.*) Spindle-shaped, *i.e.* tapering gradually at both ends. ↓ SIGMOID · ALLANTOID · RENIFORM · CRUCIFORM · VERMIFORM · PYRIFORM · OVAL · BIFID · SPINDLE-SHAPED ↑ STRUCTURE[2]

CG124 sigmoid (*adj.*) Curved in two directions, like the letter S. ↑ FUSIFORM

CG125 allantoid (*adj.*) Sausage-shaped. ↑ FUSIFORM ↓ SAUSAGE SHAPED

CG126 reniform (*adj.*) Kidney-shaped. ↑ FUSIFORM ↓ KIDNEY SHAPED

CG127 cruciform (*adj.*) Arranged in two lines, or grouped in two lines, with the two lines cutting one another at right angles as in a cross. ↑ FUSIFORM

CG128 vermiform (*adj.*) Shaped like a worm; resembling a worm in form. ↑ FUSIFORM → VERMIFORM APPENDIX

CG129 pyriform (*adj.*) Pear shaped. ↑ FUSIFORM · PEAR SHAPED

CG130 oval (*adj.*) Describes a symmetrical ovoid shape; elliptical. ↑ FUSIFORM → ELLIPTICAL

CG131 bifid (*adj.*) Forked at the terminal end; having two lobes. ↑ FUSIFORM → TERMINAL[1]

CG132 globular (*adj.*) **1** Shaped like a globe, or a globule. **2** Composed of globules. ↓ GLOMERULAR · BULBOUS · SPHERICAL · DISCOID · DISCOIDAL · COLUMNAR · CRICOID · CAMPANULATE ↑ STRUCTURE[2]

CG133 glomerular (*adj.*) Of, or to do with, a glomerulus, or a glomerule. ↑ GLOBULAR → GLOMERULUS

CG134 bulbous (*adj.*) Describes a structure similar in shape to a bulb; the term implies considerable flattening at the ends, unlike *globular* which describes a more symmetrical spherical shape. ↑ GLOBULAR · GLOBE

CG135 spherical (*adj.*) Having the shape of a sphere. ↑ GLOBULAR

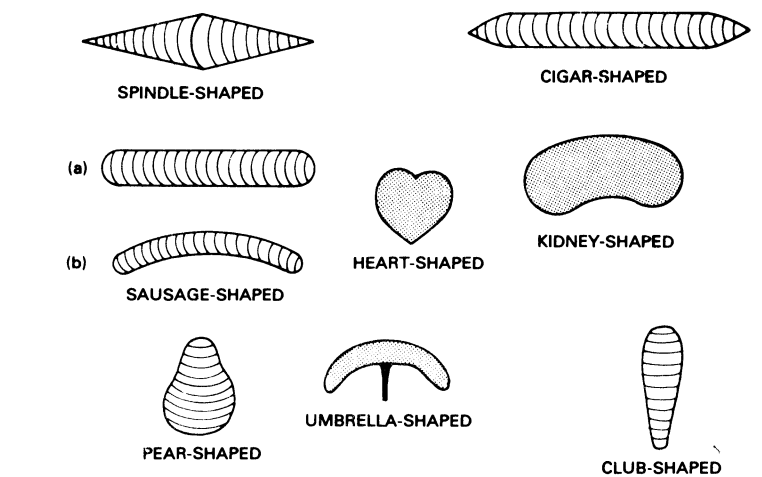
CG136 discoid (*adj.*) Shaped like a disc; flat and circular. ↑ GLOBULAR

CG137 discoidal[1] (*adj.*) Disk-like; resembling a disc in being thin and circular. ↑ GLOBULAR

CG138 columnar (*adj.*) Like a column, *e.g.* columnar epithelial cells are taller than they are broad. ↑ GLOBULAR

CG139 cricoid (*adj.*) In the form of a ring. ↑ GLOBULAR

CG140 campanulate (*adj.*) Bell shaped. ↑ GLOBULAR



CG141 spindle-shaped (*adj.*) (Of a structure) rod-like, of greatest diameter at the middle, tapering to a point at both ends. —***spindle-shape*** (*adj.*) ↓ CIGAR-SHAPED · SAUSAGE-SHAPED · KIDNEY-SHAPED · PEAR-SHAPED · UMBRELLA-SHAPED · CLUB-SHAPED · HEART-SHAPED · HALF-MOON-SHAPED ↑ STRUCTURE[2]

CG142 cigar-shaped (*adj.*) (Of a structure) rod-like, of the same diameter over most of its length, tapering to a point at both ends. —***cigar-shape*** (*n.*) ↑ SPINDLE-SHAPED

CG143 sausage-shaped (*adj.*) (Of a structure) rod-like, of the same diameter over most of its length, with rounded ends; the structure may be straight or curved. —***sausage-shape*** (*n.*) ↑ SPINDLE-SHAPED

CG144 kidney-shaped (*adj.*) Convex on the longer side and concave on the shorter side. —***kidney-shape*** (*n.*) ↑ SPINDLE-SHAPED

CG145 pear-shaped (*adj.*) Rounded in shape, spherical at one end and pyramidal at the opposite end. —***pear-shape*** (*n.*) ↑ SPINDLE-SHAPED

CG146 umbrella-shaped (*adj.*) (Of a structure) flattened and bell-shaped, convex on the upper side and concave on the lower side. —***umbrella-shape*** (*n.*) ↑ SPINDLE-SHAPED

CG147 club-shaped (*adj.*) Increasing in girth towards a rounded terminal end, *e.g.* the club-shape of fingers which are thickened at the distal end. —***club-shape*** (*n.*) ↑ SPINDLE-SHAPED → GIRTH

CG148 heart-shaped (*adj.*) (Of a structure) having two lobes on either side of the axis of symmetry, the lobes being separated by a deep indentation, and curving round to taper to a point at the opposite end. —***heart-shape*** (*n.*) ↑ SPINDLE-SHAPED

CG149 half-moon-shaped (*adj.*) Shaped like a crescent. ↑ SPINDLE-SHAPED

CG150 membrane (*n.*) **1** A very thin layer of connective tissue, covering part of an animal or a plant. **2** Connective tissue dividing cells. **3** A thin layer of cells. —MEMBRANOUS (*adj.*) ↓ VELUM · CUTICLE[2] · SEROUS MEMBRANE[1] · CUTICULARIZATION[2] ↑ STRUCTURE[2]

CG151 velum (*n.*) A thin membrane which acts as a cover to another structure; it may be a flap-like membrane for closing a cavity. ↑ MEMBRANE

CG152 cuticle[2] (*n.*) **1** The usually thin outer covering of plants and animals, formed from non-cellular material secreted by epidermal cells. Its chief function is the prevention of water-loss; it also protects the surface against mechanical injury. **2** (In higher plants) a continuous layer of cutin, with gaps for stomata and lenticels, over areas exposed to the atmosphere. **2** (In Arthropoda) a continuous layer of chitin and protein; insects possess a waxy covering on the cuticle. —CUTICULARIZATION (*n.*) ***cuticular*** (*adj.*) ↑ MEMBRANE → EPIDERMIS[2] · CUTIN

CG153 serous membrane[1] (*n.*) A membrane which secretes serum; it is formed from mesothelium and underlying connective tissue, and lines coelomic spaces in vertebrates. ↑ MEMBRANE → MESOTHELIUM · COELOMIC SPACE · PERICARDIUM · SERUM[1]

CG154 cuticularization[2] (*n.*) The process of forming a cuticle on epithelial cells of plants or animals. ↑ MEMBRANE · CUTICLE[2] → CELL WALL

CG155 filament[1] (*n.*) A long, thread-like structure, *e.g.* ***a*** the stalk of an anther; ***b*** the hypha of a fungus. —***filamentous*** (*adj.*) ↓ STRIP ↑ STRUCTURE[2]

CG156 strip (*n.*) **1** A long narrow piece of material. **2** A long narrow surface of a solid. ↑ FILAMENT[1]

CG157 membranous (*adj.*) **1** Similar to a membrane. **2** Consisting of membranes. ↓ FILAMENTOUS · NEMATOID ↑ STRUCTURE[2]

CG158 filamentous (*adj.*) Like a filament in shape; the term describes a very long, thin plant, such as spirogyra, which has a long thread-like form. Filamentous implies an internal structure associated with the shape, but **thread-like** describes the shape only. Filamentous implies a greater length than **hair-like.** ↑ MEMBRANOUS → SETACEOUS

CG159 nematoid (*adj.*) Thread-like; finer than **filamentous**, but thicker than **hair-like.** Nematoid is generally used to describe organisms; hair-like or thread-like is used to describe structures. ↑ MEMBRANOUS

CG160 convoluted (*adj.*) **1** Rolled together, so that one part covers another. **2** Giving the appearance of being rolled together in this fashion, *e.g.* shells in which the outer whorls cover the inner whorls. **3** Twisted together, so that one part covers another part, *e.g.* as in a knot of capillaries. —***convolution*** (*n.*) ↓ INVOLUTED ↑ STRUCTURE[2]

CG161 involuted (*adj.*) **1** Rolled up tightly with the edges hidden, *e.g.* leaves, when first formed, are involuted as they are tightly rolled up with the leaf edges inside. **2** (Of shells) having whorls closely coiled together. —***involution*** (*n.*) ↑ CONVOLUTED

CG162 impervious[3] (*adj.*) Describes a structure or an object that does not permit the passage of liquid. To contrast **impervious** and **impermeable**: impermeable is used with reference to both liquids and dissolved gases, impervious with reference to liquids only, *e.g.* the skin of a frog is impervious to water but is not impermeable to oxygen dissolved in the water. —***imperviousness*** (*n.*) ↑ STRUCTURE[2]

CG163 region[2] (*n.*) A part or division of an animal or a plant, usually associated with a particular function, *e.g.* ***a*** the abdominal region of a vertebrate body (the lower part of the trunk containing viscera); ***b*** the cortex is the intermediate region of a plant stem and plant root. —REGIONAL (*adj.*) ↓ TRACT[1] · TRUNK[1] · LAYER · REGIONAL · DICHOTOMOUS · CORTICAL ↑ ANATOMICAL TERMS

CG164 tract[1] (*n.*) A system, or a region of an organism, especially a group or system of parts connected or related in purpose, *e.g.* the digestive tract, or alimentary tract, con-

sists of connected parts—some organs, some specialized tissues, some connective tissues—but all concerned with the final purpose of digestion. ↓ FASCIA · FASCICLE ↑ REGION²

CG165 fascia (*n.*) **1** A sheet or band of connective tissue forming a sheath round a structure, *e.g.* the epimysium of a muscle is a fascia. **2** Tissue of this kind. **Superficial fascia** is loose connective tissue beneath the dermis of vertebrates. **Deep fascia** is tough sheets of tissue enclosing muscles. ↑ TRACT¹ → WHITE FIBROUS TISSUE

CG166 fascicle (*n.*) A small bundle or tuft of threads, fibres, rods, or stems. Also called ***fasciculus.*** ↑ TRACT¹

CG167 trunk¹ (*n.*) The main part of any branching structure, *e.g.* ***a*** the trunk of a system of blood-vessels (the aorta is the arterial trunk; ***b*** the trunk of a nerve, before it branches. ↓ CORE¹ · CORTEX¹ · MEDULLA¹ ↑ REGION²

CG168 core¹ (*n.*) The central region of a solid object, especially when the central region is different (in structure, function, etc.), *e.g.* the core of an apple is the part containing seeds, as opposed to the fleshy edible outer part; ***b*** an iron core round which a coil of wire is wound. ↑ TRUNK¹

CG169 cortex¹ (*n., pl.* **cortices**) An outer layer of a structure or organ. —CORTICATE CORTICAL (*adj.*) ↓ MEDULLA¹ (Ag) ↑ TRUNK¹

CG170 medulla¹ (*n.*) The central or inner part of an organ or a tissue. —MEDULLATED, ***medullary*** (*adj.*) ↑ TRUNK¹ · CORTEX¹ (Ag)

CG171 layer (*n.*) A spreading of material or a region of material covering a structure; it may be one of a number of such layers, *e.g.* ***a*** a thin layer of water over a field; ***b*** a thick layer of earth covering rocks; ***c*** the different layers of skin covering a fruit. ↓ STRATUM² · MOSAIC¹ ↑ REGION² → STRATIFIED²

CG172 stratum² (*n., pl.* **strata**) **1** A layer of cells or tissues, *e.g.* the stratum corneum, a layer of horny cells. **2** Vegetation of similar height in a plant community. —STRATIFIED, ***stratous*** (*adj.*) ↑ LAYER

CG173 mosaic¹ (*n.*) A pattern formed from a collection of small individual pieces, *e.g.* a mosaic picture made from very small pieces of glass. ↑ LAYER (*n.*)

CG174 regional (*adj.*) Of, to do with, or situated in, a region. ↓ ZONAL · ZONATE · ZONARY¹ ↑ REGION²

CG175 zonal (*adj.*) Of or to do with a zone, *e.g.* ***a*** in zonal distribution, different sets of objects or organisms appear in different zones; ***b*** the zonal character of a plant tissue in which zones are clearly visible. ↑ REGIONAL → ZONE¹

CG176 zonate (*adj.*) A structure or surface marked with rings or zones. ↑ REGIONAL

CG177 zonary¹ (*adj.*) Describes a method of placentation in a placenta. ↑ REGIONAL → PLACENTA²

CG178 dichotomous (*adj.*) Branching into two equal parts; the process may be repeated, leading to repeated forking. ↓ BIRAMOUS ↑ REGION² → BIFID · BIFURCATE

CG179 biramous (*adj.*) Dividing terminally into two branches. ↑ REGION²

CG180 cortical (*adj.*) Of or to do with a cortex. ↓ CORTICATE · STRATIFIED² · INTERSPERSED ↑ REGION²

CG181 corticate (*adj.*) Possessing a cortex in its structure. ↑ CORTICAL

CG182 stratified² (*adj.*) Describes a structure composed of layers, *e.g.* stratified epithelium. —***stratification*** (*n.*) ↑ CORTICAL → EPITHELIUM

CG183 interspersed (*adj.*) Situated at irregular intervals amongst other structures, *e.g.* in the epidermis of *Hydra*, sensory nerve cells are interspersed between the musculo-epithelial cells (*i.e.* there are fewer sensory cells) □ *contour feathers interspersed with down feathers* ↑ CORTICAL

CG184 link¹ (*n.*) A connecting part between moving parts of machinery or between steps in an argument or theory, *e.g.* ***a*** a chain is composed of links; ***b*** a moving rod links a piston with a valve mechanism; ***c*** fossils provide links in the theory of evolution. —LINKAGE (*n.*) LINK (*v.*) ***linked*** (*adj.*) ↓ BATTERY¹ · PASSAGE · CONDUCTION · ANASTOMOSIS · OVERLAP² · BIFURCATE · CONFLUENT · RAMOSE · STENOSED ↑ ANATOMICAL TERMS

CG185 battery¹ (*n.*) A number of identical structures grouped together, *e.g.* a battery of cnidoblasts in a coelenterate. ↓ ATTACHMENT¹ · OVERLAP¹ · SUCKER² · INSERTION¹ · HINGE · FLAP¹ · PLUG¹ · PEG ↑ LINK¹ → CNIDOBLAST · COELENTERATE

CG186 attachment¹ (*n.*) **1** A structure by which an organism or parts of an organism is fixed to an object or to another organism, *e.g.* the foot of a hydroid (such as *Hydra*) is its attachment. **2** The state of being fixed to an object. It implies that the object to which the attachment is made is larger or more secure, and that the object attached is free to move while remaining attached □ *an organism is attached to an object* —***attach*** (*v.*) ***attached*** (*adj.*) ↑ BATTERY¹ → DETACHMENT (Cn)

CG187 overlap¹ (*n.*) The part of a flat structure which covers another structure when it lies on top of it □ *there is some overlap between the two surfaces* —OVERLAP (*v.*) ↑ BATTERY¹

CG188 sucker² (*n.*) An animal structure which grips by suction; a sucker is usually disc-shaped. ↑ BATTERY¹ → SUCTION

CG189 insertion¹ (*n.*) The way an organ, or structure, is joined at the point of attachment. —INSERTED (*adj.*) ↑ BATTERY¹

CG190 hinge (*n.*) A structure joining two parts so that one part can move relative to the other, altering the angle between the two parts, *e.g.* a door has two or more hinges which allow the door to be opened and shut. —***hinged*** (*adj.*) ↑ BATTERY¹

CG191 flap¹ (*n.*) A movable structure, fastened or hinged at one side, covering an opening or a hole, *e.g.* the epiglottis is composed of elastic cartilage and covers the opening to the trachea. ↑ BATTERY¹

CG192 plug[1] (*n.*) An object or structure which blocks a tube or vessel to prevent fluid flowing into or leaking away from the structure containing the vessel or tube. The focus is either on the prevention of loss of fluid, or the prevention of entry of fluid, *e.g.* ***a*** a plug of cotton wool put in a nose to prevent loss of blood from nose bleeding; ***b*** ear plugs put in ears to prevent loud noises damaging the ear-drum (the plugs prevent compression waves in air reaching the ear-drum) ☐ *a plug for the vascular bundle* ↑ BATTERY[1] → OBSTRUCT · EAR-DRUM

CG193 peg (*n.*) **1** A piece of wood or metal on which to hang or fix an object. **2** A piece of wood or metal used to fasten together pieces of wood or other objects. ↑ BATTERY[1]

CG194 passage (*n.*) **1** The act of passing from one place to another, *e.g.* the passage of food through the alimentary canal. **2** A structure through which solids, liquids or gases can pass, *e.g.* ***a*** the anus is the passage for faeces from the rectum to the exterior; ***b*** a passage cell for the conduction of water in vascular tissue. It is a general term with no reference to the shape of the structure or of its connection to any other structure. ↓ MEATUS · SINUS · VESSEL[1] · CERVIX[1] · VESTIBULE[1] · GULLEY ↑ LINK[1]

CG195 meatus (*n.*) A channel or passage, *e.g.* ***a*** an acoustic meatus; ***b*** a nasal meatus. ↑ PASSAGE

CG196 sinus (*n.*) **1** A hollow or recess in a tissue. **2** A dilated tube or chamber. **3** A long, narrow, hollow space originating from a site of infection inside the body, and forming an outlet to the exterior for pus from the infection. ↑ PASSAGE

CG197 vessel[1] (*n.*) **1** A tube for conducting a liquid in a living organism, *e.g.* ***a*** a blood vessel for conducting blood. **2** (G.S.) A hollow object for containing liquids. ↑ PASSAGE → BLOOD VESSEL · TRACHEA[3]

CG198 cervix[1] (*n.*) **1** A narrow tube-like structure connecting a mouth or an opening with the cavity of a hollow structure. **2** The neck. —CERVICAL (*adj.*) ↑ PASSAGE

CG199 vestibule[1] (*n.*) **1** A small cavity leading into a much larger cavity or into a passageway. **2** A small cavity connecting two larger cavities. —***vestibular*** (*adj.*) ↑ PASSAGE

CG200 gulley (*n.*) A large, open drain, or a similar natural passage for water in the ground, worn away by water flowing along it. ↑ PASSAGE

CG201 conduction (*n.*) **1** The passage of a liquid containing solutes through a system of tubes which direct the flow of the liquid, *e.g.* the conduction of blood by the vascular system of an animal. **2** The passage of a physiological disturbance through a cell or tissue; the disturbance is the result of a stimulus, *e.g.* the conduction of an impulse by a nerve. ↓ VALVE[1] · LINKAGE[1] ↑ LINK[1] → IMPULSE[1] · STIMULUS

CG202 valve[1] (*n.*) A structure which allows fluids to flow through it in one direction only; this is done by closing the vessel, or canal, to stop backward flow. —***valvular*** (*adj.*) ↑ CONDUCTION

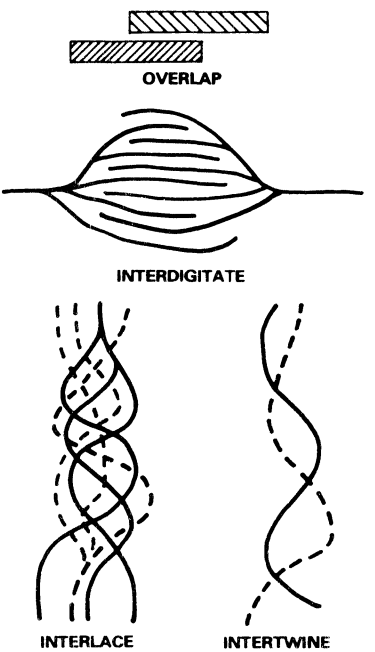
CG203 linkage[1] (*n.*) **1** The act or state of being linked, *e.g.* ***a*** the magnetic linkage between two coils when the same lines of force pass through both. **2** The tendency of two or more genes to remain associated through successive generations. —LINK (*v.*) ↑ CONDUCTION · LINK[1]

CG204 anastomosis (*n.*) The formation of a network of interconnecting vessels, channels, nerves, so that the vessels, etc., anastomose, *i.e.* alternative paths for conduction are available if one or more vessels, etc., are obstructed or otherwise impaired. ↑ LINK[1] → ANASTOMOSE

CG205 overlap[2] (*v.t.,i.*) **1** (*v.i.*) (Of a flat structure) to cover partially another similar structure. **2** (*v.t.*) To place a structure over and cover a part of another structure. —OVERLAP (*n.*) ***overlapping*** (*adj.*) ↓ GRIP · LINK[3] · INTERDIGITATE · INTERLACE · INTERTWINE ↑ LINK[1]

CG206 grip (*v.t.,i.*) To hold firmly. —GRIP (*n.*) ↑ OVERLAP[2]

CG207 link[3] (*v.t.,i.*) To bind loosely together; to associate with, *e.g.* ***a*** certain chromosomes are linked with the mechanism of the inheritance of certain characteristics; ***b*** two coils can be linked by magnetic lines of force. The term implies a looser association than **connect**. ↑ OVERLAP[2]

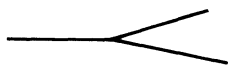


CG208 interdigitate (*v.i.*) (Of two structures) to grow towards each other and to branch, or put out projections, so that the branches of one structure lie between the branches of the other structure and the two structures become linked but not joined, *e.g.* villi of the placenta and villi of the uterus interdigitate, and constituents of blood plasma are exchanged. —***interdigitation*** (*n.*) ↑ OVERLAP[2] · LINK[3]

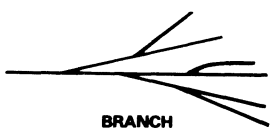
CG209 interlace (*v.i.*) (Of organisms) to bind together by growing across and round each other in an intricate pattern, similar to the threads in cloth. —***interlaced*** (*adj.*) ↑ OVERLAP[2]

CG210 intertwine (*v.i.*) (Of two or more structures) to twist round each other, as climbing stems do when they grow twisted round each other. —***intertwined*** (*adj.*) ↑ OVERLAP[2]

CG211 bifurcate (*v.i.*) To form two branches; to fork so that the distal end of the structure is V-shaped. —***bifurcation*** (*n.*) ***bifurcate*** (*adj.*) ↓ BRANCH[1] · ARBORIZE · ANASTOMOSE · RAMIFY ↑ LINK[1]



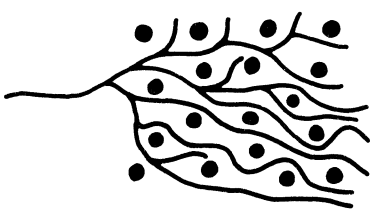
BIFURCATE



BRANCH

ARBORIZE

ANASTOMOSE



RAMIFY

CG212 branch[1] (*v.i.*) To form branches from a main structure, and to repeat the process several times. —BRANCH (*n.*) ***branched*** (*adj.*) ↑ BIFURCATE

CG213 arborize (*v.i.*) To branch repeatedly, similar to the branching of a tree, so that the main structure forms very many small structures, like the twigs on a tree. —***arborization*** (*n.*) ↑ BIFURCATE

CG214 anastomose (*v.i.*) (Of tubes, ducts, vessels or fibres) to branch and rejoin to form a network of connecting vessels, etc., so that various alternative paths exist, allowing a fluid or a nervous impulse to find an alternative path if one path becomes blocked or broken, *e.g.* blood vessels, the veins in a leaf, nerves, etc., all anastomose. —***anastomosis*** (*n.*) ***anastomosed*** (*adj.*) ↑ BIFURCATE

CG215 ramify (*v.i.*) To branch repeatedly, forming a complex network which covers a defined area or space, *e.g.* ***a*** from the solar plexus, nerves ramify to the various viscera; ***b*** the mycelium of a fungus ramifies over the surface of a plant tissue. The focus is on the covering, or growth, over a specific area. The term can be used of several structures. —***ramification*** (*n.*) ↑ BIFURCATE

CG216 confluent (*adj.*) Flowing together, *i.e.* describing the fluid from two vessels joining to form fluid flowing through one vessel. The two streams of fluid are confluent and the two vessels are also confluent. —***confluence*** (*n.*) ↓ BRANCHING (An) ↑ LINK[1]

CG217 branching (*adj.*) Describes a structure which branches repeatedly. ↑ CONFLUENT (An)

CG218 ramose (*adj.*) (Of a structure) branching extensively (but not as extensively as in **arborization**). ↓ RAMIFEROUS · RAMIPAROUS ↑ LINK[1]

CG219 ramiferous (*adj.*) Describes a branching structure spreading over an area. ↓ RAMIPAROUS ↑ RAMOSE

CG220 ramiparous (*adj.*) Describes a structure with the disposition to branch when growing. ↑ RAMOSE

CG221 stenosed (*adj.*) (Of a tubular structure) permanently narrowed, as in a pore, a duct, or a vessel; a state usually resulting from disease. Contrast **constricted,** which is a distortion of a tube, etc., with **stenosed**, which is a deformation of a tube, etc. —***stenosis*** (*n.*) ↓ INSERTED ↑ LINK[1]

CG222 inserted (*adj.*) (Of a structure) united by natural growth to a larger or more important structure. —***insertion*** (*n.*) ↑ STENOSED

CG223 partition[1] (*n.*) **1** A solid structure which divides a space into separate parts. A general term with no reference to the nature or function of the structure. The focus is on the effect of division. **2** The action of dividing or parting. —PART (*v.*) ↓ SEPTUM · SEPTAL ↑ ANATOMICAL TERMS

CG224 septum (*n., pl.* **septa**) A wall or partition separating two cavities, or two chambers, or two masses of tissue, *e.g.* ***a*** the septa in fruits such as oranges and in shells which are divided into chambers; ***b*** the septa of the heart dividing it into four chambers; ***c*** the septa in the nose separating the nasal cavities. —SEPTAL, SEPTATE, SEPTIFORM (*adj.*) ↓ SEPTULUM · LAMELLA[1] ↑ PARTITION[1]

CG225 septulum (*n.*) **1** A small septum. **2** A secondary septum. ↑ SEPTUM

CG226 lamella[1] (*n., pl.* **lamellae**) A thin plate or scale-like structure, made of tissue that is not bone or cartilage, *i.e.* soft tissue. LAMELLATE · NON-SEPTATE · ASEPTATE ↑ PAR- → LAMINA[1]

CG227 septal (*adj.*) Of or to do with a septum. ↓ SEPTATE · SEPTIFORM · LAMELLAR · LAMELLATE · NON-SEPTATE · ASEPTATE ↑ PARTITION[1]

CG228 septate (*adj.*) Describes a structure divided, by walls or partitions, into chambers or cavities, *e.g.* the internal structure of citrus fruits is septate. —NON-SEPTATE, ASEPTATE (*adj.*) ↓ NON-SEPTATE (I) · ASEPTATE (I) ↑ SEPTAL

CG229 septiform (*adj.*) In the form of a septum, *i.e.* acting as a dividing partition. ↑ SEPTAL

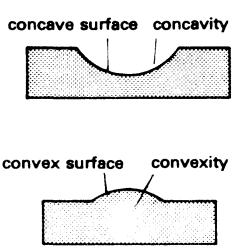
CG230 lamellar (*adj.*) Describes a structure composed of lamellae. ↑ SEPTAL

CG231 lamellate (*adj.*) Possessing lamellae. ↑ SEPTAL

CG232 non-septate (*adj.*) Without septa. ↑ SEPTAL

CG233 aseptate (*adj.*) Alternative term for NON-SEPTATE.

CG234 surface[2] (*n.*) **1** The outside of a solid body. **2** The upper face of a volume of liquid in contact with air, or other atmosphere. **3** The limit of a solid or liquid where it is in contact with another substance. A surface has length and breadth, but no thickness, *i.e.* it exists in two dimensions only. A **plane surface** is one which contains the whole of a straight line connecting any two points on the surface. A surface may be smooth, rough, wrinkled, wide, or narrow. —SURFACE, SUPERFICIAL (*adj.*) ↓ CONCAVITY · AREA[2] · CRUMPLE · SUPERFICIAL · CONCAVE · INTERCALARY ↑ ANATOMICAL TERMS



CONCAVE AND CONVEX

CG235 concavity (*n.*) **1** The state of being concave. **2** A concave hollow or surface. ↓ CONVEXITY (I) · CONCAVE ↑ SURFACE[2]

CG236 convexity (*n.*) The state of having a convex surface. ↓ CONVEX ↑ CONCAVITY (I)

CG237 indentation (*n.*) **1** A break, or cut, in an edge, *e.g.* a small break in the edge of a front tooth. **2** A small groove on a surface, *e.g.* a line made with a pen on paper makes an indentation in the surface of the paper. —***indent*** (*v.*) ***indented*** (*adj.*) ↑ CONCAVITY

CG238 perforation (*n.*) **1** A small hole through a surface, *e.g.* the surface of the brain has perforations through which small blood vessels pass. **2** The act of perforating a surface. ↑ CONCAVITY → PERFORATED

CG239 area[2] (*n.*) A surface, especially enclosed by a ridge, *e.g.* the area vasculosa; the area opaca. —***areal*** (*adj.*) ↑ SURFACE[2]

CG240 crumple (*v.t.,i.*) **1** (*v.t.*) To crush a surface so that it forms folds or creases. **2** (*v.i.*) To contract into folds and creases. —***crumpled*** (*adj.*) → CRUMBLE[1] (Sn)

CG241 superficial (*adj.*) On or near the surface, *e.g.* superficial blood-vessels are those near the surface of the skin. ↓ SURFACE[3] · DEEP (Ag) · ADHESIVE ↑ SURFACE[2] → PERIPHERAL

CG242 surface[3] (*adj.*) Of or to do with a surface, *e.g.* surface tension. ↑ SUPERFICIAL

CG243 deep (*adj.*) Describes a position below a surface, usually at a distance below the surface, *e.g.* a deep wound penetrates the tissues below the skin. ↑ SUPERFICIAL (Ag)

CG244 adhesive (*adj.*) Describes a substance which causes two surfaces to stick firmly together; the term implies stronger clinging than **sticky.** —ADHESIVE, ***adhesion*** (*n.*) ADHERE (*v.*) ↑ SUPERFICIAL → ADHERE

CG245 concave (*adj.*) Describes a curved hollow that is broad and shallow. —CONCAVITY (*n.*) ↓ CONVEX (I) · BICONVEX · BICONCAVE ↑ SURFACE[2]

CG246 convex (*adj.*) Describes a small projection that curves outwards. —***convexity*** (*n.*) ↑ CONCAVE (I)

CG247 biconvex (*adj.*) Describes a structure which is convex on opposite sides. ↑ CONCAVE

CG248 biconcave (*adj.*) Describes a structure which is concave on opposite sides. ↑ CONCAVE

CG249 intercalary (*adj.*) Describes a structure inserted between other, usually different structures, *e.g.* ***a*** the growth of meristematic tissue between permanent tissues is an intercalary growth; ***b*** the veins between the main veins of an insect's wing are intercalary veins; ***c*** the cartilage between vertebrae forms intercalary discs. —INTERCALATED (*adj.*) ↓ INTERCALATED ↑ SURFACE[2]

CG250 intercalated (*adj.*) Alternative term for INTERCALARY.

CG251 coat[2] (*n.*) A protective layer in the form of a thin covering of solid or liquid, *e.g.* ***a*** a coat of paint (to protect an object); ***b*** a coat of slime round a bacterial cell (protective in function); ***c*** a protein coat round a

virion, which protects the nucleic acid in the centre. —***coated*** (*adj.*) COAT (*v.*) ↓ INTEGUMENT[1] · TUNIC · INVAGINATE · ENCLOSE · CHLAMYDATE ↑ ANATOMICAL TERMS

CG252 integument[1] (*n.*) A structure or layer which covers, invests, or coats, a structure underneath it, *e.g.* ***a*** the integument enclosing the nucellus of an ovule; it develops into the seed coat. The skin of an animal is an integument. The focus is on the structure or layer rather than on a protective function. ↓ INVESTMENT · MANTLE[1] · SHEATH · COATING · ENVELOPE · ENCLOSURE · VAGINA[1] ↑ COAT[2]

CG253 investment (*n.*) An outer covering fitting tightly over an organism, structure or part. The focus is on the tight fit. —***investing, invested*** (*adj.*) INVEST (*v.*) ↓ MANTLE[1] (Sn) ↑ INTEGUMENT[1]

CG254 mantle[1] (*n.*) An outer covering fitting loosely over an organism, structure or part, *e.g.* the mantle of a mollusc. The focus is on the loose fit. ↓ CHLAMYDATE ↑ INTEGUMENT[1]

CG255 sheath (*n.*) A protective covering fitting closely to a structure or a part of an organism, especially an elongated structure or part, *e.g.* ***a*** the lower part of a leaf can act as a sheath on a stem; ***b*** the wing of an insect is protected by a sheath. The focus is on the protective function. —***sheathe*** (*v.*) ↑ INTEGUMENT[1]

CG256 coating (*n.*) A thin layer of liquid or solid covering a surface, *e.g.* a coating of mucilage. ↑ INTEGUMENT[1]

CG257 envelope (*n.*) A structure which covers an object completely; the focus is on the completeness of the covering, *e.g.* ***a*** the envelope covering a letter; ***b*** a floral envelope, consisting of leaves, covering the megasporangium and microsporangium. —ENVELOP (*v.*) ↑ INTEGUMENT[1] → MEGASPORANGIUM · MICROSPORANGIUM

CG258 enclosure (*n.*) That which is enclosed, *e.g.* ***a*** a piece of paper, put with a letter inside a cover, is an enclosure; ***b*** a piece of ground surrounded by a wall or fence is an enclosure, *i.e.* the focus is on the ground, and the containing partition is not necessarily mentioned. ↑ INTEGUMENT[1]

CG259 vagina[1] (*n., pl.* **vaginae**) A sheath or a sheath-like tube covering a structure. —INVAGINATE, EVAGINATE (*v.*) VAGINATE (*adj.*) ↑ INTEGUMENT[1]

CG260 tunic (*n.*) A soft membrane or tissue investing the outside surface of a structure, *e.g.* ***a*** the tunic investing the kidney; ***b*** the tunic investing an artery (the outside cover of the tube). The focus is on the softness of the tunic; it is not a protective coat against injury. ↓ LINING (Cn) · TUNICA[1] · INVEST ↑ COAT[2] · INVESTMENT

CG261 lining (*n.*) A soft membrane or tissue, investing the inside surface of a structure, *e.g.* the endothelial lining of an artery (endothelium covers the inside surface of the tube). ↑ TUNIC (Cn)

CG262 tunica[1] (*n.*) Alternative term for TUNIC.

CG263 invaginate (*v.t.*) **1** To cover with a sheath. **2** To turn the outside to the inside, especially by rolling up, *e.g.* part of a bladder worm is invaginated; it is tucked inside itself, to form a proscolex. ↓ EVAGINATE (Cn) ↑ COAT

CG264 evaginate (*v.t.*) To unsheath; to turn the inside to the outside, especially by unrolling, *e.g.* the proscolex of a bladder evaginates to form the scolex. ↑ INVAGINATE (Cn)

CG265 enclose (*v.t.*) To cover completely with a structure, containing vessel, or receptacle. The focus is on the object which is covered, *e.g.* the kidney is enclosed in a membrane (the kidney is the object under discussion). Any area of space is enclosed in a surrounding structure □ *the bud is* enclosed in *a mass of young leaves* —ENCLOSURE (*n.*) ↓ ENVELOP (Sn) · INVEST (Sn) ↑ COAT[2] (*n.*)

CG266 envelop (*v.t.*) To enclose by growth or movement; the focus is on the structure which encloses an object, *e.g.* floral leaves envelop the sexual structures of a flower. Contrast: the sexual structures of a flower are *enclosed in* floral leaves (focus on the object enclosed) □ *the trees were* enveloped in *mist* —ENVELOPE (*n.*) ***enveloping*** (*adj.*) ↓ INVEST (Sn) ↑ ENCLOSE

CG267 invest (*v.t.*) To cover by fitting tightly; the focus is on the tight fit, *e.g.* an integument invests a seed. —INVESTMENT (*n.*) ***investing*** (*adj.*) ↑ ENCLOSE · ENVELOP (Sn)

CG268 chlamydate (*adj.*) Describes a structure covered by a mantle. ↓ VAGINATE ↑ COAT[2] · MANTLE[1]

CG269 vaginate (*adj.*) Describes a structure invested with a sheath. ↑ CHLAMYDATE

CG270 cavity (*n.*) A hollow space inside a solid body. ↓ CHAMBER · LUMEN[1] · SAC · LACUNA[1] · OPENING · ENCYST[1] · VESICULAR · LACUNAR[1] ↑ ANATOMICAL TERMS

CG271 chamber (*n.*) A hollow space closed by walls, with or without an opening to the exterior; usually the space is one of several contained in a larger structure, *e.g.* ***a*** the four chambers of the heart closed by septa, with openings to the exterior guarded by valves; ***b*** the chambers (loculi) of an ovary, closed to the exterior. ↓ POUCH · BLADDER · CAPSULE[1] · CYST[1] · ENCYSTATION · ENCYSTMENT ↑ CAVITY

CG272 pouch (*n.*) A bag-like structure, usually open at the top, formed from skin or similar integument, *e.g.* ***a*** the pouch of a marsupial for carrying young; ***b*** the food pouch in the cheek of a monkey. ↑ CHAMBER

CG273 bladder (*n.*) A membranous sac containing or storing fluid (*i.e.* liquids or gases). ↑ CHAMBER

CG274 capsule[1] (*n.*) A membrane tightly enclosing an organ or structure; the focus is on the lack of an opening to the exterior, *e.g.* the synovial capsule is a membrane enclosing a sac so that the liquid contents cannot leak out. —***capsulated, encapsulated*** (*adj.*) ↑ CHAMBER

CG275 cyst[1] (*n.*) **1** A round, bag-like structure surrounding a protozoon in a resting or dormant stage. The structure is a resistant wall, usually of chitin, *e.g.* in adverse conditions, amoeba rounds itself into a ball and forms a cyst. **2** A hollow, bag-like structure, without an opening, occurring in animal tissues. The cyst contains a liquid, or semi-liquid substance, *e.g.* sweat or milk. A cyst may be caused by a folding in of the skin enclosing a hair, this gives rise to inflammation, which then forms the cyst. —ENCYSTMENT, ENCYSTATION (*n.*) ENCYST (*v.*) ***encysted*** (*adj.*) ↑ CHAMBER → VACUOLE

CG276 encystation (*n.*) The act of forming a cyst. ↑ CHAMBER

CG277 encystment (*n.*) The state of a protozoon being dormant in a cyst. ↑ CHAMBER

CG278 lumen[1] (*n.,pl.* **lumina**) The space in a tube, sac or gland; the central cavity in a cell. The lumen is surrounded by a wall of either cells or membranes; it is usually, but not always, filled with a liquid. ↓ PIT · FOLLICLE[2] · BORE[1] · LUMINA ↑ CAVITY

CG279 pit (*n.*) **1** A small depression in a surface or in skin, *e.g.* ***a*** the pits left in the skin after smallpox nodules have dried up; ***b*** the pits in cell walls of passage cells. **2** A deep cavity with a small circumference, *e.g.* the hair follicle consists of a pit of epidermal cells. —***pitted*** (*adj.*) ↑ LUMEN[1]

CG280 follicle[2] (*n.*) A sheath-like cavity, or tubular hollow, with a narrow mouth, lined with epithelial or glandular tissue. —***follicular*** (*adj.*) ↑ LUMEN[1]

CG281 bore[1] (*n.*) **1** The hollow in a tube, *e.g.* small bore tubing. **2** The size of the diameter of the hollow in a tube, *e.g.* a tube with a bore of 5 mm. —BORE (*v.*) ↑ LUMEN[1]

CG282 lumina (*n.pl.*) Plural of LUMEN[1]. ↑ LUMEN[1]

CG283 sac (*n.*) A bag-like receptacle surrounded by a membrane; it is a general term not describing any detail of structure, *e.g.* the ovisac of earthworms for the temporary storage of ova. —SACCULATION, SACCULE (*n.*) SACCULATE (*adj.*) ↓ SACCULUS[1] · VESICLE · VESICULATION · SACCULATION · SACCULE[1] · VARIOLE ↑ CAVITY → RECEPTACLE[2]

CG284 sacculus[1] (*n.,pl.* **sacculi**) A small sac, *e.g.* the sacculus rotundus, a dilation between the ileum and caecum with chyle-retaining lymphoid tissue in Lagomorphia. —SACCULATION (*n.*) SACCULATE (*adj.*) ↑ SAC

CG285 vesicle (*n.*) **1** A small, globular hollow or sac in tissues, especially one containing liquid or gas. **2** One of three cavities in the brain of an embryo of a vertebrate. It develops into one of the three major parts of the brain of the adult. **3** A small blister on the skin; the vesicle is filled with watery fluid. —VESICULATION (*n.*) VESICULATE, VESICULAR (*adj.*) ↑ SAC (Sn)

CG286 vesiculation (*n.*) **1** The forming of vesicles, *e.g.* vesiculation occurs round the membraneous sacs of the Golgi apparatus. **2** The state of possessing vesicles. ↑ SAC

CG287 sacculation (*n.*) **1** The formation of sacs or sacculi. **2** The state of consisting of a series of sacs, *e.g.* the sacculation of the colon, where the integument is gathered into sacs. ↑ SAC

CG288 saccule[1] (*n.*) Alternative term for SACCULUS[1] (↑).

CG289 variole (*n.*) A small hollow in the skin, particularly a pock-mark caused by smallpox. ↑ SAC · PIT

CG290 lacuna[1] (*n.,pl.* **lacunae**) (In invertebrates) a space between tissues which performs the same function as a vascular vessel in vertebrates, *i.e.* the conduction of body liquids. —LACUNAR (*adj.*) ↓ INTERSTICE ↑ CAVITY → VASCULAR SYSTEM

CG291 interstice (*n.*) A narrow space between two structures, *e.g.* ***a*** an interstice between two cells; ***b*** the narrow space between two pieces of wood in a floor is an interstice; ***c*** the space between two or more particles (ions, nuclei, or atoms) in a crystal. —INTERSTITIAL (*adj.*) ↑ LACUNA[1]

CG292 opening (*n.*) A hole of any shape in a surface; it is a general term not giving an exact description. ↓ APERTURE[2] · ORIFICE · SLIT[2] · PORE ↑ CAVITY → OSCULUM · OSTIOLE

CG293 aperture[2] (*n.*) An opening with a regular shape, *i.e.* its diameter can be measured. ↑ OPENING

CG294 orifice (*n.*) An opening at the end of a tube or duct. ↑ OPENING

CG295 slit[2] (*n.*) A very narrow opening in a surface. —SLIT (*v.*) ↑ OPENING → SLIT[1]

CG296 pore (*n.*) A minute opening in the integument, passing fluids in or out of an organism, *e.g.* a sweat pore, a pore in a sponge. —POROUS (*adj.*) ↑ OPENING → PERFORATION

CG297 encyst[1] (*v.t.,i.*) To enclose or become enclosed with a cyst, *e.g.* *Entamoeba* (a protozoan) encysts. ↑ CAVITY CYST[1]

CG298 bore[2] (*v.t.*) **1** To make a hole through a solid substance, using a pointed instrument which is turned in the hole, or (of animals) using a modified mouth part. A hole bored through a rod, along its length, changes it into a tube. —BORE (*n.*) ***bored*** (*adj.*) ↑ ENCYST[1]

CG299 vesicular (*adj.*) Of or to do with vesicles; composed of vesicles; having vesicles present, *e.g.* ***a*** a vesicular gland under the skin of a fruit which secretes essential oils; ***b*** the vesicular bodies in the Golgi region of a cell. ↓ VESICULATE · SACCULATE ↑ CAVITY

CG300 vesiculate (*adj.*) Having the shape or appearance of a vesicle, *e.g.* the small, separate bodies in the Golgi region of a cell are vesiculate. ↑ VESICULAR

CG301 sacculate (*adj.*) Containing or provided with sacculi. ↑ VESICULAR

CG302 lacunar[1] (*adj.*) Describes a system of cavities found in invertebrates for the purpose of conducting body liquids, *e.g.* as in a haemocoel. → INTERSTITIAL · POROUS[2] ↑ CAVITY → vascular

CG303 interstitial (*adj.*) Situated in interstices, or spaces between structures, *e.g.* in

the epidermis of *Hydra*, interstitial cells are situated between the bases of the much larger musculo-epithelial cells. ↑ LACUNAR[1]

CG304 porous[2] (*adj.*) Describes a solid structure with many pores; the focus is on the ability of fluids to pass readily through the solid, *e.g.* ***a*** a porous pot allows gases to pass through quickly and allows liquids to pass through slowly; ***b*** porous rocks allow water to seep through. ↑ LACUNAR[1] · PORE → SEEP

CG305 osteology (*n.*) The study of bones. ↓ CREST[1] · SPINE[1] · FORAMEN · ARTICULAR SURFACE · LAMINA[2] · FUSED[2] · FLEXIBLE ↑ ANATOMICAL TERMS

CG306 crest[1] (*n.*) A sharp, well-defined ridge on a bone. ↓ CAPITULUM[1] · TROCHLEA ↑ OSTEOLOGY

CG307 capitulum[1] (*n.*) A head of a bone, hair, tentacle, etc.; it is usually knob-shaped. ↑ CREST[1]

CG308 trochlea (*n.*) A pulley-shaped bony surface or projection, especially one over which a tendon runs, *e.g.* the trochlea at the distal end of the humerus, into which the radius and the ulna are jointed. —***trochlear*** (*adj.*) ↑ CREST[1]

CG309 spine[1] (*n.*) **1** A pointed, bony process. **2** An elongated process with a blunt end. —***spinous*** (*adj.*) ↓ CONDYLE · TUBERCLE[1] · TUBERCULUM[1] · TUBEROSITY · EPICONDYLE ↑ OSTEOLOGY

CG310 condyle (*n.*) A smooth rounded projection of bone. —***condylar*** (*adj.*) ↑ SPINE[1]

CG311 tubercle[1] (*n.*) A localized, rounded, bony projection with either a rough or smooth surface, to which muscles are attached. ↑ SPINE[1] → ARTICULATE

CG312 tuberculum[1] (*n.*) Alternative term for TUBERCLE[1] (↑).

CG313 tuberosity (*n.*) Alternative term for TUBERCLE[1].

CG314 epicondyle (*n.*) A bony projection placed above an articulating surface and articulating with it. —***epicondylar*** (*adj.*) ↑ SPINE[1] → ARTICULATE

CG315 foramen (*n.,pl.* **foramina**) A hole in a bone; the opening to a canal in a bone. ↓ FOSSA · SULCUS · HIATUS ↑ OSTEOLOGY

CG316 fossa (*n.,pl.* **fossae**) A hollow which is longer than it is broad. ↑ FORAMEN

CG317 sulcus (*n.,pl.* **sulci**) A groove in a bone. ↑ FORAMEN

CG318 hiatus (*n.*) A gap in a bone. ↑ FORAMEN

CG319 articular surface (*n.*) A smooth surface on a bone for articulation with another bone; it is covered with cartilage. ↓ FACET (H) · SUTURE · SYMPHYSIS · ANKYLOSIS · ANCHYLOSIS ↑ OSTEOLOGY → ARTICULATE

CG320 facet (*n.*) A small articular surface. ↑ ARTICULAR SURFACE

CG321 suture (*n.*) **1** (In animals) the line of junction of, or joint between, two immovable bones or similar hard structures, or the junction between two segments of the body, *e.g.* ***a*** the sutures in the skull of vertebrates are fixed joints between the cranial bones, the bones having irregular or serrated edges; ***b*** the suture between two whorls of a mollusc's shell. **2** (In plants) the line of junction between two structures such as carpels, or a line of dehiscence. —***sutural*** (*adj.*) ↑ ARTICULAR SURFACE

CG322 symphysis (*n.*) **1** The coalescence of two structures, by growing to form a join, *e.g.* ***a*** the symphysis of two bones; ***b*** pubic symphysis. **2** The flat surface of a bone in contact with a similar surface of another bone, both surfaces being covered with smooth cartilage. A slight gliding movement is allowed between the bones forming the joint; fibrocartilage binds the bones together in their relative positions, *e.g.* the joint between the centra of two vertebrae. —***symphysial*** (*adj.*) ↑ ARTICULAR SURFACE

CG323 ankylosis (*n.*) The union of two or more bones when ankylosed. —ANKYLOSED (*adj.*) ↓ ANKYLOSED ↑ ARTICULAR SURFACE

CG324 anchylosis (*n.*) Alternative term for ANKYLOSIS.—ANCHYLOSED (*adj.*)

CG325 lamina[2] (*n.,pl.* **laminae**) A thin plate or sheet of bone. —***laminar, laminate*** (*adj.*) ↑ OSTEOLOGY → MEMBRANE

CG326 fused[2] (*adj.*) United into one part by two parts growing towards each other until they grow together, *e.g.* ***a*** the sutures in the mammalian cranium are open in the infant, but become fused with age, and form one single bone; the parts are no longer distinguishable; ***b*** the teeth of an amphibian are fused to its jaw. ↓ ANKYLOSED · ANCHYLOSED ↑ OSTEOLOGY

CG327 ankylosed (*adj.*) Describes two or more bones, or other similar hard structures, firmly united; the two bones remain distinguishable, *e.g.* if the two bones of a movable joint become united and the ability to move is lost, then the bones are ankylosed. ↑ FUSED[2]

CG328 anchylosed (*adj.*) Alternative term for ANKYLOSED(↑)

CG329 flexible (*adj.*) Describes the disposition to be bent easily, *e.g.* ***a*** a flexible cord used to make connections in electrical circuits (usually called flex); ***b*** a flexible joint, one that is not stiff from injury or age. —***flexion,*** FLEXOR (*n.*) FLEX (*v.*) ↓ RIGID (I) ↑ OSTEOLOGY

CG330 rigid (*adj.*) Unable to be bent or distorted (a mechanical property of bodies), *e.g.* a long bone in a mammalian skeleton is rigid. Contrast **robust**, which concerns the ability to function and carry out life processes. ↑ FLEXIBLE (I)

CG331 anatomy (*n.*) The systems of organs and structures in an organism; in animals, it consists of osteology (the bone system); arthrology (the articulatory system); myology (the muscular system); the vascular system; neurology (the nervous system); splanchnology (the visceral system). —***anatomical*** (*adj.*) ↓ SPLANCHNOLOGY · HOMOLOGY · VESTIGE · ORGAN[1] · HOMOLOGOUS[1] · VESTIGIAL ↑ ANATOMICAL TERMS

CG332 splanchnology (*n.*) The branch of

anatomy dealing with the viscera, (*i.e.* the splanchnic system). ↓ MYOLOGY ↑ ANATOMY → VISCUS · SPLANCHNIC

CG333 myology (*n.*) The branch of anatomy concerned with muscles. ↑ SPLANCHNOLOGY

CG334 homology (*n.*) The condition of similarity in structure and development of organs or other parts of the body; the parts may or may not have similar functions, *e.g.* ***a*** the wing of a bird and the forelimb of a tetrapod exhibit homology; they have similar embryological origins, although they have different functions; ***b*** the wing of a bird and the wing of a bat have similar origins, structures and functions, and exhibit homology □ *the fin of a fish and the paddle of a whale exhibit homology* —HOMOLOGUE (*n.*) HOMOLOGOUS (*adj.*) ↓ ANALOGY[2] · HOMOLOGUE[1] · ANALOGUE ↑ ANATOMY → EMBRYOLOGY

CG335 analogy[2] (*n.*) The condition of similarity of function but not of structure or origin, *e.g.* the wing of an insect and the wing of a bird are dissimilar in structure and origin, but they have a similar function; they exhibit analogy. —ANALOGUE (*n.*) ANALOGOUS (*adj.*) ↓ ANALOGUE ↑ HOMOLOGY → ANALOGY[1]

CG336 homologue[1] (*n.*) One of a series of homologous organs or structures. ↑ HOMOLOGY

CG337 analogue (*n.*) Describes one of a series of analogous structures or organs, *e.g.* an insect's wing is an analogue of a bird's wing. ↑ HOMOLOGY

CG338 vestige (*n.*) A small, imperfectly developed structure, or part of an organism, which has no function, but in some ancestor may have been fully developed and functional, *e.g.* ***a*** the kiwi, a flightless bird, has a vestige of a wing hidden in its body feathers; ***b*** the human vermiform appendix is a vestige from man's herbivorous ancestors □ *the human caecum is a* vestige *of an herbivorous ancestor* —VESTIGIAL (*adj.*) ↓ RUDIMENT ↑ ANATOMY

CG339 rudiment (*n.*) A part, or structure, which is imperfectly developed because, ***a*** it is still a group of cells, or a tissue which has not given rise to the developed structure, *e.g.* gill rudiments in an embryo, or ***b*** development has been arrested either in the individual, or because the part is no longer fulfilling a function. —RUDIMENTARY (*adj.*) ↑ VESTIGE

CG340 organ[1] (*n.*) A part of an organism which is both a structural and a functional unit; it is composed of various tissues, including connective tissue, *e.g.* ***a*** the heart; ***b*** a kidney; ***c*** the stomach; ***d*** a lung. ↓ ORGANISM · SYSTEM[3] · ORGANOGENESIS ↑ ANATOMY

CG341 organism (*n.*) Any individual, plant or animal, composed of true organs which work in conjunction with one another. ↑ ORGAN[1]

CG342 system[3] (*n.*) All the structures in the body of a multicellular organism concerned with one particular function of the organism. A system in an animal consists of one or more organs interconnected by tubes, ducts, or sinuses, *e.g.* ***a*** the respiratory system of a tetrapod vertebrate (the lungs and associated tubes and sinuses); ***b*** the circulatory system of an arthropod (heart, haemocoel, sinuses, and tubes); ***c*** the vascular system of a plant. —SYSTEMIC (*adj.*) ↑ ORGAN[1]

CG343 organogenesis (*n.*) The differentiation of tissues to form organs. ↑ ORGAN[1]

CG344 homologous[1] (*adj.*) Describes organs or structures which exhibit homology, *e.g.* a bird's wing and man's arm are homologous appendages □ *the fin of a fish is homologous with the limb of a tetrapod* ↓ ANALOGOUS · SYSTEMIC · ORGANIC[2] ↑ ANATOMY

CG345 analogous (*adj.*) Describes organs or structures which exhibit analogy, *e.g.* the wings of insects and birds are analogous □ *the wing of a bird is analogous with the wing of an insect* ↑ HOMOLOGOUS[1]

CG346 systemic (*adj.*) **1** Of or to do with a system. **2** Describes a general distribution throughout the body of a multicellular organism. ↑ HOMOLOGOUS

CG347 organic[2] (*adj.*) **1** Of or to do with living organisms or living tissues. **2** Formed or to do with organs of animals. ↑ HOMOLOGOUS

CG348 vestigial (*adj.*) **1** Of or to do with a vestige. **2** Describes any structure which is small and imperfectly developed. ↓ RUDIMENTARY · CONGENITAL · MALFORMED · OBSOLETE[2] ↑ ANATOMY

CG349 rudimentary (*adj.*) In an imperfectly developed condition, as in a rudiment, *e.g.* in man, the exoskeleton is rudimentary, being limited to nails on the digits and enamel on the teeth. ↑ VESTIGIAL

CG350 congenital (*adj.*) Describes a condition with which an animal is born; present when born, *e.g.* haemophilia is a congenital disease. ↑ VESTIGIAL

CG351 malformed (*adj.*) Not of normal shape, *i.e.* fully developed, but grown into an incorrect shape, *e.g.* as in a person with two nails on a split thumb. —***malformation*** (*n.*) ↑ VESTIGIAL → DEFORMED (Sn)

CG352 obsolete[2] (*adj.*) Describes a characteristic of a species which becomes less distinct from generation to generation, *e.g.* the wing of a kiwi (a flightless bird from New Zealand) has been reduced over many generations to a very small structure no longer visible from the outside of the bird, so its wings have become obsolete. To contrast **vestigial** and **obsolete**: a kiwi possesses a vestigial wing (only a vestige of a wing); the characteristic of being a winged bird is obsolete. —OBSOLESCENCE (*n.*) ↑ VESTIGIAL → OBSOLESCENCE

Plant Anatomy

CH001 plant[1] (*n.*) An organism (with the exception of the fungi) with the ability to manufacture complex organic substances from simpler inorganic substances. Plants lack the power of locomotion, respond slowly to stimulation, and lack excretory organs. There are two types of plant, according to anatomical structure; thallophytes and cormophytes. ↓ THALLOPHYTE · STALK · RHIZOID · HYPODERMIS[2] · MONOPODIAL · AERIAL[2] · VEGETATIVE · GROUND TISSUE[1] · THALLUS ↑ ANATOMICAL TERMS

CH002 thallophyte (*n.*) A plant possessing a thallus, but no true stem and no true root. —***thallophytic*** (*adj.*) ↓ CORMOPHYTE (An) · RHIZOCARP · HERB · MONOPODIUM · SYMPODIUM ↑ PLANT → THALLUS

CH003 cormophyte (*n.*) A plant possessing a true stem and a true root. ↑ THALLOPHYTE (An)

CH004 rhizocarp (*n.*) A perennial herb, *i.e.* a plant without a persistent stem but whose roots persist for a number of seasons; the stem is replaced each season. ↑ THALLOPHYTE

CH005 herb (*n.*) **1** A seed plant without a woody stem. **2** (G.S.) A plant used for medicinal or culinary purposes. —***herbaceous*** (*adj.*) ***herbage*** (*n.*) ↑ THALLOPHYTE

CH006 monopodium (*n.*) A plant with a single main axis, from which all lateral branches arise; the axis increases in length by growth at the apex, *e.g.* a pine tree is a monopodium. —***monopodial*** (*adj.*) ↑ THALLOPHYTE

CH007 sympodium (*n.*) A plant with a composite axis formed from a main axis and successive axillary branches or axes; each axillary branch arises when budding at the apex of an axis has stopped, *e.g.* many orchids. —***sympodial*** (*adj.*) ↑ THALLOPHYTE

CH008 stalk (*n.*) A long, unbranched, supporting structure, usually thin compared with its length, with a separate structure at its terminal end, *e.g.* ***a*** the unbranched stem of a plant supporting a flower; ***b*** the stalk supporting the eye in some crustaceans (*e.g.* the lobster). The term is generally used to describe a structure smaller than a stem and much smaller than a trunk. ↓ STIPE[1] · TRUNK[3] · BRANCH[2] ↑ PLANT → STEM · PEDICEL · PEDUNCLE · PETIOLE · STIPULE

CH009 stipe[1] (*n.*) **1** The stalk of brown algae (seaweeds), anchored at one end by a holdfast and attached to the thallus of the alga at the other end. **2** (In ferns) the stem of a frond. **3** Alternative term for CAUDEX. ↑ STALK → THALLUS · CAUDEX

CH010 trunk[3] (*n.*) The main stem of a tree, particularly the region which does not bear branches. ↑ STALK

CH011 branch[2] (*n.*) **1** A stem that is an outgrowth of a larger stem, or of the main stem of a plant. **2** Any small structure growing or arising, from a larger structure, *e.g.* ***a*** a branch of a root; ***b*** a branch of the vagus nerve. —***branching*** (*adj.*) BRANCH (*v.*) ↑ STALK → STEM

CH012 rhizoid (*n.*) **1** A hair-like structure consisting of one or several cells; it functions as a root. Rhizoids are borne on the base of moss stems, and on the undersurface of fern prothalli and liverworts, and are also found in some algae. **2** A fungal hypha growing into a substrate. ↓ HAUSTORIUM ↑ PLANT → ROOT[1]

CH013 haustorium (*n.,pl.* **haustoria**) An outgrowth from the root, stem, or hypha,of a parasitic plant; its function is to penetrate and draw nutrients from the host plant. —***haustorial*** (*adj.*) ↑ RHIZOID → HYPHA · PARASITIC

CH014 hypodermis[2] (*n.*) A layer of cells immediately below the epidermis of the leaves and stems of some plants, *e.g.* some gymnosperms; the cells are often mechanically strengthened. The function of the hypodermis is either, ***a*** to act as water storage tissue, or, ***b*** to provide an extra protective layer. —HYPODERMAL (*adj.*) ↑ PLANT

CH015 monopodial (*adj.*) Describes the branching of a plant from one primary axis, with the branches arising in succession from the base to the apex, *e.g.* cymes. ↓ SYMPODIAL · SESSILE[2] · FASCICULAR[2] ↑ PLANT → CYME

CH016 sympodial (*adj.*) Describes the branching of a plant from a primary axis by the growth of axillary shoots when budding at the apex of the axis has stopped. ↑ MONOPODIAL

CH017 sessile[2] (Of flowers, leaves, etc.) without a stalk. ↓ FASCICULAR[2] ↑ PLANT → SEDENTARY · STALKED (An)

CH018 fascicular[2] (*adj.*) Arranged in tufts or bundles. ↑ MONOPODIAL

CH019 aerial[2] (*adj.*) Describes a plant structure growing in the air, *e.g.* aerial roots are roots growing in air, above the ground. ↓ SUBTERRANEAN (An) · ADVENTITIOUS · HYPODERMAL ↑ PLANT

CH020 subterranean (*adj.*) Describes a plant structure growing under the surface of the ground, *e.g.* a subterranean stem grows in the soil, and does not appear above ground. ↑ AERIAL[2] (An)

CH021 adventitious (*adj.*) Describes tissues, organs or structures, arising in an abnormal or unusual position, *e.g.* adventitious roots growing at nodes in stems. ↑ AERIAL[2]

CH022 hypodermal (*adj.*) Of or to do with the hypodermis. ↑ AERIAL[2] → HYPODERMIC

CH023 vegetative (*adj.*) Describes an organism, or parts of an organism, whose function is somatic growth; the term is mainly applied to parts of a plant such as stem, root, leaves, thallus; it excludes those parts of the plant connected with sexual reproduction, *e.g.* flowers, oogonia,

antheridia, and also sporangia, but it includes those parts used in non-sexual reproduction, *e.g.* bulbs and corms. ↓ HERBACEOUS · WOODY · ANNUAL[1] · BIANNUAL · BIENNIAL[1] · PERENNIAL[1] ↑ PLANT → FLOWER · SPORANGIUM

CH024 herbaceous (*adj.*) Having the characteristics of a herb; describes a plant that lacks a persistent stem. ↓ WOODY (Ag) ↑ VEGETATIVE

CH025 woody (*adj.*) Describes a plant in which the stem has a marked amount of wood, has a suberized epidermis, and is persistent. ↑ VEGETATIVE

CH026 annual[1] (*adj.*) Describes an event that takes place every year. If the event takes place more than once a year, the prefixes *bi-*, *tri-*, etc., are added, *e.g.* triannual describes an event taking place three times a year □ *flowering in some plants is an annual event* —ANNUAL (*n.*) ↑ VEGETATIVE

CH027 biannual (*adj.*) Describes an event that takes place twice a year. ↑ VEGETATIVE

CH028 biennial[1] (*adj.*) **1** Describes an event that takes place every two years, *i.e.* on alternate years. **2** Describes an organism that has a life cycle of two years. —BIENNIAL (*n.*) ↑ VEGETATIVE

CH029 perennial[1] (*adj.*) **1** Describes an event that takes place year after year, *e.g.* a tree that produces fruit every year exhibits perennial bearing of fruit. **2** Describes a structure or organism, that persists for year after year, *e.g.* a tree is a perennial plant. —PERENNIAL, PERENNATION (*n.*) ↑ VEGETATIVE

CH030 ground tissue[1] (*n.*) The connective tissue of a plant; it includes pith, cortex, medullary rays, and hypodermis; it is normally composed of thin-walled parenchyma. ↓ PITH · SECONDARY THICKENING ↑ PLANT · HYPODERMIS[2]

CH031 pith (*n.*) (In gymnosperms and dicotyledons) the central core of a stem which has a cylindrical stele; it is usually composed of parenchymatous tissue. In some roots, the core tissue develops into parenchyma instead of xylem, and such roots have a pith. The function of pith is food storage. Also called ***medulla***. —***pithy*** (*adj.*) ↓ CORTEX[3] · SAP · MEDULLA[3] ↑ GROUND TISSUE[1]

CH032 cortex[3] (*n.,pl.* **cortices**) A region of parenchymatous tissue surrounding the stele of stems and roots; it is enclosed by the epidermis of the plant. In many plants nutrients, such as starch grain or sucrose, are stored in the cortical cells. —***cortical*** (*adj.*) ↑ PITH → PARENCHYMA

CH033 sap (*n.*) The liquid in a plant, especially the liquid containing dissolved food materials, which passes through the conducting vessels of the plant. ↑ PITH → CELL SAP · VACUOLE

CH034 medulla[3] (*n.*) Alternative term for PITH (↑).

CH035 secondary thickening (*n.*) (In gymnosperms and most dicotyledons) the formation of extra supporting tissue and extra vascular tissue by the activity of the cambium; the stem and root increase in diameter. Secondary thickening occurs in plants with persistent aerial stems. ↑ GROUND TISSUE[1] → SECONDARY XYLEM · SECONDARY PHLOEM · CAMBIUM

CH036 thallus (*n.,pl.* **thalli**) A simple, vegetative plant body, consisting of one or of a number of cells; it is not differentiated into stem, root or leaves. A multicellular thallus may have the cells arranged in branching or unbranching filaments, consisting of chains of cells or arranged in plates. The filaments may be flattened and ribbon-shaped. —THALLOID, THALLOSE, THALLINE (*adj.*) THALLOPHYTE (*n.*) ↓ HOLDFAST · HYPHA · MYCOSIS · THALLINE ↑ PLANT → THALLOPHYTA · PROTHALLUS

CH037 holdfast (*n.*) A disc-like structure, at the end of a thallus or at the end of a stalk, for attachment of the plant to a support. ↓ FROND[2] ↑ THALLUS

CH038 frond[2] (*n.*) The thallus of certain seaweeds. ↑ HOLDFAST

CH039 hypha (*n.,pl.* **hyphae**) A thread-like filament of the vegetative mycelium (thallus) of a fungus. It is tubular and grows at the tip to increase in length; lateral branches form new hyphae. The hyphae of most fungi are septate with a minute pore in the cross-wall, so that the protoplasm is continuous throughout them. The hyphae of Phycomycetes are non-septate. —***hyphal*** (*adj.*) ↓ MYCELIUM · RHIZOMORPH · PROTONEMA ↑ THALLUS

CH040 mycelium (*n.,pl.* **mycelia**) A network of hyphae forming the vegetative structure, or thallus, of a fungus. —***mycelial*** (*adj.*) ↑ HYPHA → HAUSTORIUM · RHIZOID

CH041 rhizomorph (*n.*) (In some fungi) a root-like hypha, or mass of hyphae, that effects the vegetative spread of the fungus. ↑ HYPHA → RHIZOID

CH042 protonema (*n.*) (In mosses) a fine, branching, thread-like structure which grows from a spore; lateral buds develop on it and grow into moss plants. ↑ HYPHA → MUSCI

CH043 mycosis (*n.*) Any disease of man, or any other animal, caused by a fungus, *e.g.* tinia. ↑ THALLUS

CH044 thalline (*adj.*) Consisting of a thallus. ↓ THALLOID · THALLOSE ↑ THALLUS

CH045 thalloid (*adj.*) Resembling a thallus. ↑ THALLINE

CH046 thallose (*adj.*) Alternative term for THALLOID.

CH047 vascular plant (*n.*) A plant possessing a vascular system (xylem and phloem) for the conduction of water and nutrients in solution; a member of the Tracheophyta. ↓ STELE · SIPHONOSTELE · VASCULAR RING · PERICYCLE · PERIPHLOIC · ENDARCH · STEM · ROOT[1] → ANATOMICAL TERMS

CH048 stele (*n.*) (In a stem, or root) a central cylinder of vascular tissue and strengthening tissue; it consists of xylem, phloem, and pericycle. Alternatively a stele can be in the form of discrete bundles; some

steles also contain pith and medullary rays. The stele is surrounded by a wall of endodermis; the structure of a stele varies in different groups of plants. The stele and the cortex are the main divisions of a stem or root. —***stelar*** (*adj.*) ↓ PROTOSTELE · HAPLOSTELE · ACTINOSTELE · PLECTOSTELE ↑ VASCULAR PLANT → VASCULAR BUNDLE · XYLEM · PHLOEM · MEDULLARY RAY

CH049 protostele (*n.*) The simplest form of stele; it consists of a central core of xylem surrounded by a cylinder of phloem. It occurs in almost all roots, and in the stems of some ferns and club-mosses. ↓ HAPLOSTELE (H) · ACTINOSTELE (H) · PLECTOSTELE (H) ↑ STELE

CH050 haplostele (*n.*) A protostele in which the transverse section of the xylem is circular. ↑ STELE

CH051 actinostele (*n.*) A protostele in which the transverse section of the xylem is star-shaped. ↑ STELE

CH052 plectostele (*n.*) A protostele in which xylem and phloem tissues alternate, with strips of xylem embedded in the phloem. ↑ STELE

CH053 siphonostele (*n.*) A stele structure in which xylem and phloem form concentric cylinders round a central pith. With phloem surrounding xylem and xylem surrounding pith, it is an **ectophloic** structure; with phloem both inside and outside the cylinder of xylem, and a central core of pith, it is an **amphiphloic** structure. A siphonostele is found in most *Filicales* (Horsetails), Club-mosses, and in some ferns. ↓ DICTYOSTELE · SOLENOSTELE · MERISTELE ↑ VASCULAR PLANT

CH054 dictyostele (*n.*) (In some ferns) a modified siphonostele surrounding a central core of pith; it is an amphiphloic siphonostele broken up by numerous leaf gaps into a network of meristeles. ↑ SIPHONOSTELE

CH055 meristele (*n.*) Vascular strands from a stele: in a dictyostele the strands anastomose; in other steles it is a vascular strand supplying a leaf. ↑ SIPHONOSTELE

CH056 solenostele (*n.*) Alternative term for SIPHONOSTELE (↑).

CH057 vascular ring (*n.*) (In gymnosperms and dicotyledons) a stele in the form of a ring of vascular bundles around a central core of xylem. ↓ AMPHIPHLOIC · ECTOPHLOIC CULAR PLANT

CH058 vascular cylinder (*n.*) Alternative term for VASCULAR RING.

CH059 pericycle (*n.*) (In gymnosperms and dicotyledons) a thin layer of parenchyma surrounding the stele inside the endodermis; fibres are sometimes included in the pericycle. ↑ VASCULAR PLANT

CH060 periphloic (*adj.*) Describes a stelar arrangement with phloem peripheral to a core of xylem. ↓ AMPHIPHLOIC · ECTOPHLOIC ↑ VASCULAR PLANT

CH061 ectophloic (*adj.*) Describes a stelar arrangement in which phloem surrounds a cylinder of xylem with the xylem surrounding a central core of pith. ↑ PERIPHLOIC

CH062 amphiphloic (*adj.*) Describes a stelar arrangement in which phloem is situated outside and inside a cylinder of xylem. ↑ PERIPHLOIC

CH063 endarch (*adj.*) Describes a stele with protoxylem at the centre, or with protoxylem round a central core of pith, *e.g.* as in the stems of seed plants. ↓ EXARCH (An) · MESARCH ↑ VASCULAR PLANT

CH064 exarch (*adj.*) Describes a stele with protoxylem external to metaxylem or protoxylem next to the pericycle, *e.g.* as in roots. ↑ ENDARCH (An)

CH065 mesarch (*adj.*) Describes a stele with metaxylem surrounding protoxylem in all directions, *e.g.* as in the stems of ferns. ↑ ENDARCH

CH066 stem (*n.*) **1** The aerial portion of a vascular plant, bearing any of the following; branches, leaves, buds, flowers, or other reproductive structures. Many stems are rod-like, standing erect to display leaves and flowers; they have a growing point at the terminal end. Other stems are subterranean (*e.g.* a rhizome, corm or bulb); some climb on aerial supports; some spread over the ground. Stems are distinguished by their internal structure of vascular bundles in a ring round a central core (dicotyledons), or vascular bundles scattered throughout the stem (monocotyledons and ferns); protoxylem is normally endarch. The basic functions of stems are, ***a*** the translocation of water and metabolites to all parts of the plant; ***b*** support in erect aerial stems. Additional functions are, ***a*** vegetative reproduction (runners, stolons, etc.); ***b*** food storage (rhizomes, tubers, etc.); ***c*** acting as leaves (cladodes). **2** Any structure resembling a plant stem, *e.g.* the brain stem. ↓ ERECT STEM · ROSETTE STEM · PROCUMBENT STEM · CLIMBING STEM · SHOOT · SECONDARY CORTEX · NODE[1] · ETIOLATION · TWINE[1] · ERECT[2] ↑ VASCULAR PLANT → RHIZOME · STOLON

CH067 erect stem (*n.*) A stem standing upright without support; the height of the stem can vary between a few centimetres and as much as 100 metres in giant trees. ↑ STEM

CH068 rosette stem (*n.*) A stem with nodes so close together that the leaves are borne one immediately above the other, producing a cluster of leaves in close circles. ↑ STEM

CH069 procumbent stem (*n.*) A stem that creeps along the ground, usually developing adventitious roots; the term includes runners, stolons and layers. ↑ STEM

CH070 climbing stem (*n.*) A stem that uses other structures (usually neighbouring plants) for support; the term includes twiners and stems which use tendrils. ↑ STEM

CH071 shoot (*n.*) **1** The stem bearing leaves, etc., of a young vascular plant; it develops from the plumule. **2** A structure which is a new growth from a parent structure, *e.g.* ***a*** the first stage of a horn growing from the head of an animal; ***b*** the aerial shoot from a rhizome; it lasts for one

season. ↓ CAUDEX · CLADODE · SPROUT[1] · PHYLLOCLADE ↑ STEM

CH072 caudex (*n.*) The stem of a woody plant, with no secondary thickening, *e.g.* the stems of palm trees (monocotyledons) or tree-ferns. ↑ SHOOT

CH073 cladode (*n.*) A modified stem that is leaf-like in appearance and function, *e.g.* the stem of asparagus and some cacti. ↑ SHOOT

CH074 sprout[1] (*n.*) Alternative term for SHOOT (↑).

CH075 phylloclade (*n.*) Alternative term for CLADODE.

CH076 secondary cortex (*n.*) A layer of closely fitting, parenchymatous, cortical cells with suberized walls formed from phellogen in stems; it is situated on the inner side of the layer of cork. ↓ PHELLODERM · ANNUAL RING · SAPWOOD · HEARTWOOD · AXIS[3] ↑ STEM → EXODERMIS · PHELLOGEN

CH077 phelloderm (*n.*) Alternative term for SECONDARY CORTEX.

CH078 annual ring (*n.*) The annual increment of growth in a woody stem; it is formed from secondary xylem (wood) in plants of temperate climates. There is a noticeable difference between the secondary xylem formed in the spring (with a large wood element) and that formed in the autumn (with a small wood element); this gives rise to a ring-like appearance. The successive annual rings appear in a transverse section of the stem as a series of concentric circles. The approximate age of the tree can be determined from the number of annual rings. In tropical climates, growth is uniform throughout the year, and no rings appear. ↑ SECONDARY CORTEX → SECONDARY THICKENING

CH079 sapwood (*n.*) The paler, softer, outer layer of wood in a tree trunk or branch surrounding the heartwood; water is conducted in the xylem vessels of sapwood. ↑ SECONDARY CORTEX

CH080 heartwood (*n.*) The darker, central core of wood in a tree trunk; it no longer conducts water. It is composed of xylem but contains no living cells; the cell walls are impregnated with lignin. The wood is hard and resists decay. ↑ SECONDARY CORTEX

CH081 axis[3] (*n.,pl.* **axes**) Part of a plant, consisting of the main stem and root; it bears leaves, branches, hairs, etc. ↑ SECONDARY CORTEX

CH082 node[1] (*n.*) A region of a stem where a leaf or branch arises; the stem is usually swollen at a node. —***nodal*** (*adj.*) ↓ INTERNODE[2] · HYPOCOTYL · EPICOTYL · COLEOPTILE ↑ STEM

CH083 internode[2] (*n.*) The part of a stem between two successive nodes, a region where no leaves grow. —***internodal*** (*adj.*) ↑ NODE[1]

CH084 hypocotyl (*n.*) The part of a seedling stem below the cotyledons and above the primary root; it elongates in epigeal growth. In the hypocotyl the stele structure changes from that of a root to that of a stem. ↓ EPICOTYL (Cn) ↑ NODE[1] → EPIGEAL[1]

CH085 epicotyl (*n.*) The part of a seedling stem above the cotyledons; it elongates in hypogeal growth. ↑ HYPOCOTYL (Cn) · NODE[1] → HYPOGEAL

CH086 coleoptile (*n.*) The protective sheath surrounding the plumule of a monocotyledonous seedling; it forms the first leaf of the aerial shoot. ↑ NODE[1] → COLEORHIZA · PLUMULE

CH087 etiolation (*n.*) A condition produced in green plants when grown in darkness; the plants become pale yellow because of the absence of chlorophyll, the stems become very long because of abnormal lengthening of the internodes, and the leaves remain small. —ETIOLATE (*v.*) ETIOLATED (*adj.*) ↓ NUTATION · FASCIATION · CIRCUMNUTATION ↑ STEM

CH088 nutation (*n.*) The spiral growth exhibited by the apex of a stem; it arises from the continuous circular change in position of the most rapidly-growing regions and is a different phenomenon from the twining behaviour of climbing stems. The effect is most clearly exhibited in stems, but also occurs in roots, flower-stalks, tendrils and in the sporangiophores of some fungi, *i.e.* in the apex of a growing plant structure. ↑ ETIOLATION

CH089 fasciation (*n.*) The thickening of stems or branches by coalescence; an abnormal form of growth. ↑ ETIOLATION

CH090 circumnutation (*n.*) Alternative term for NUTATION. ↑ NUTATION

CH091 twine[1] (*v.i.*) (Of a stem) to twist round and round a support in the fashion of a corkscrew. For any one species the direction or twining does not vary; it may be either clockwise or anti-clockwise and is viewed in the direction of growth; all the plants of a species twine in the same direction. —***twining*** (*n.*) ***entwined*** (*adj.*) ↓ ETIOLATE ↑ STEM

CH092 etiolate (*v.i.*) To undergo etiolation. ↑ TWINE[1]

CH093 erect[2] (*adj.*) Standing upright; without any bend. —ERECTOR (*n.*) ***erect*** (*v.*) ↓ PROCUMBENT (An) · CAULINE · DECUMBENT · ETIOLATED ↑ STEM

CH094 procumbent (*adj.*) (Of stems) trailing or lying on the ground. ↑ ERECT[2] (An) → PROSTRATE

CH095 cauline (*adj.*) Of, to do with, or arising from, a stem. ↑ ERECT[2]

CH096 decumbent (*adj.*) (Of a stem or stipe) creeping along the ground, but with the apex rising. ↑ ERECT[2]

CH097 etiolated (*adj.*) Describes a plant exhibiting etiolation. ↑ ERECT[2] → STUNTED (An)

CH098 root[1] (*n.*) (In vascular plants) the usually subterranean portion of the plant, anchoring it in the ground and absorbing water and dissolved mineral salts from the soil. Roots and stems cannot always be distinguished by their position above or below the ground, as the roots, or parts of the root, of some plants can be aerial. Roots

do not bear leaves or buds, but may bear root hairs, and may have the apex protected by a root-cap. Roots are distinguished by their internal structure of vascular tissue in a central core with the protoxylem normally exarch. Some roots (tuberous) are swollen by food storage, *e.g.* carrot. —ROOTLESS (*adj.*) ROOT (*v.*) ↓ PROP ROOTS · BUTTRESS ROOTS · STILT ROOTS · AERIAL ROOTS · BREATHING ROOTS · PRIMARY ROOT · ROOT SYSTEM · ROOT HAIR · NODULE[2] · ROOT[3] · RHIZOPHOROUS ↑VASCULAR PLANT →RADIX · RHIZOID · ENDODERMIS · EPIDERMIS[1]

CH099 prop roots (*n.pl.*) Adventitious roots arising from nodes on branches of trees, growing down into the soil and providing support for the branch. ↑ ROOT[1]

CH100 buttress roots (*n.pl.*) Alternative term for STILT ROOTS on trees where the roots and trunk are not separated; the roots project out from the trunk. ↑ ROOT[1]

CH101 stilt roots (*n.pl.*) Adventitious roots arising from nodes on the main stem, growing downwards into the soil and providing support for the stem; the roots only grow from one or two nodes near to the ground. ↑ ROOT[1]

CH102 aerial roots (*n.pl.*) Adventitious roots that grow from nodes and do not grow into the soil, such as the spongy-tipped roots of orchids which absorb water vapour from the air. ↑ ROOT[1]

CH103 breathing roots (*n.pl.*) Roots that grow upwards into the air, arising as lateral branches of a tap-root system; their function is to supply oxygen to the root system, *e.g.* breathing roots of mangrove trees which grow in swamps. ↑ ROOT[1]

CH104 primary root (*n.*) The root of a plant which develops from the radicle of a seed. ↓ TAP ROOT · ADVENTITIOUS ROOT · FIBROUS ROOT · PNEUMATOPHORE · ROOTLET ↑ ROOT[1]

CH105 tap root (*n.*) A persistent primary root, growing vertically downwards, with secondary, smaller, lateral roots growing in acropetal succession. The tap root of some species of plants can become swollen with a food reserve, *e.g.* the carrot. ↑ PRIMARY ROOT

CH106 adventitious root (*n.*) A root developing from a part of a plant other than as a branch of a primary root; it develops from a node at an inferior position, or from a leaf. ↑ PRIMARY ROOT

CH107 fibrous root (*n.*) One of a tuft of adventitious roots, all aproximately of equal diameter, growing from the base of a stem or from a hypocotyl; smaller, lateral roots may be borne on a fibrous root. ↑ PRIMARY ROOT

CH108 pneumatophore (*n.*) Alternative term for BREATHING ROOT (↑).

CH109 rootlet (*n.*) An ultimate branch of a root, usually small. ↑ PRIMARY ROOT

CH110 root system (*n.*) There are two basic patterns of root arrangement, ***a*** the tap-root system found in dicotyledons; ***b*** a fibrous root system found in monocotyledons. ↓ RHIZOTAXIS ↑ ROOT[1]

CH111 rhizotaxis (*n.*) The arrangement in which roots grow. ↑ ROOT SYSTEM

CH112 root hair (*n.*) A unicellular, tubular outgrowth from an epidermal cell of a root; it has a thin wall in close contact with soil particles. Large numbers of root hairs grow from the epidermis, just behind the region of active cell division at the tip of the root, in a zone called the piliferous layer. As the root grows downwards the older root hairs degenerate, and new root hairs appear nearer the root apex, so that the piliferous layer moves downwards in the same relative position to the root apex. The function of root hairs is to increase greatly the absorbing surface of the root. ↓ ROOT CAP · COLEORHIZA · CALYPTRA · ROOT SHEATH · EXODERMIS ↑ ROOT[1]

CH113 root cap (*n.*) A mass of loosely arranged cells forming a cap over the apex of a root, protecting the apex as the root is forced through the earth during growth. It is formed from calyptrogen. ↑ ROOT HAIR → CALYPTROGEN

CH114 coleorhiza (*n.*) The protective sheath surrounding the radicle of a grass seedling. ↑ ROOT HAIR → COLEOPTILE

CH115 calyptra (*n.*) Alternative term for ROOT-CAP (↑).

CG116 root sheath (*n.*) Alternative term for COLEORHIZA (↑).

CH117 exodermis (*n.*) The outer layer of the older part of a root, in a region where the piliferous layer has withered; its consists of closely fitting cortical cells with suberized walls. –***exodermal*** (*adj.*) ↑ ROOT HAIR → EPIDERMIS[1] · SUBERIN · SECONDARY CORTEX

CH118 nodule[2] (*n.*) A swelling in a root in which nitrogen-fixing bacteria are contained; it occurs in leguminous plants. It is usually known as a root nodule. ↓ ROOT TUBERCLE ↑ ROOT[1] → NODULE[1]

CH119 root tubercle (*n.*) Alternative term for NODULE[2].

CH120 root[3] (*v.i.*) (Of plants) to become established in soil by the growth of strong roots. ↑ ROOT[1]

CH121 rhizophorous (*adj.*) (Of plants) root-bearing, *e.g.* a tree is rhizophorous. ↓ ROOTLESS (An) ↑ ROOT[1]

CH122 rootless (*adj.*) Without roots. ↑ RHIZOPHOROUS (An)

Animal Anatomy

CJ001 metazoa (*n.pl., sing.* **metazoon**) Animals with many cells, *i.e.* animals other than protozoa (unicellular animals), with the exception of the sponges (Parazoa). The structure of sponges differs so much from that of other multicellular animals, they are excluded from metazoa. There are three types of metazoa, according to anatomical structure: coelenterates, acoelomates, coelomates. ↓ HYDROCOEL · COELENTERON · ECTODERM · COELOM · PERITONITIS · DIPLOBLASTIC · PERIVISCERAL · VISCUS · SOMA · TRUNK[2] → ANATOMICAL TERMS

CJ002 hydrocoel (*n.*) (In echinoderms) a water vascular system consisting of a system of canals and ducts which run throughout the body; it is developed from the embryonic coelom. ↓ WATER VASCULAR SYSTEM · SPONGOCOEL ↑ METAZOA

CJ003 water vascular system (*n.*) **1** (In sponges) a system of canals opening to the exterior through ostia, branching and finally entering the spongocoel. **2** (In echinoderms) a system of canals containing water which enters from the sea by pores, and leaves the canals to enter the body cavity. ↑ HYDROCOEL

CJ004 spongocoel (*n.*) The central cavity of a sponge; it is connected to the exterior, ***a*** through a water vascular system; ***b*** by an osculum, through which water leaves the spongocoel. ↑ HYDROCOEL

CJ005 coelenteron (*n.*) A single cavity, with one opening to the exterior, in the body of diploblastic animals (*e.g. Hydra*, jelly fish, sea-anemones); it is the gut of the animal. The coelenteron has an inner layer of endoderm, and an outer layer of ectoderm. Not all diploblastic animals possess a coelenteron. —COELENTERATA ↓ MESOGLOEA · COLLENCHYMA[2] ↑ METAZOA → COELENTERATA

CJ006 mesogloea (*n*) A layer of jelly-like material between the ectoderm and the endoderm of diploblastic animals. The layer may be very thin (as in *Hydra*) with cell processes in it from ectodermal and endodermal cells, or it may be thick and fibrous (as in jelly-fish) and contain many cells. Cells in the mesogloea never form organs, tissues, or specialized cells. Compare ectoderm, endoderm, and mesoderm which do form organs, tissues, and specialized cells. ↓ ECTODERM ↑ COELENTERON

CJ007 collenchyma[2] (*n.*) The middle layer of a sponge. ↑ COELENTERON → SPONGIN

CJ008 ectoderm (*n.*) The outer layer of cells of an animal embryo; the term is usually applied to the primitive germ-layer of cells while they are still clearly marked and before tissues develop. Epidermis, hair, nails and nerve tissues develop from ectoderm. The term also describes the outer layer of cells of a diploblastic animal. —***ectodermal*** (*adj.*) ↓ ENDODERM · MESODERM · PARIETAL MESODERM · VISCERAL MESODERM ↑ METAZOA → GERM-LAYER

CJ009 endoderm (*n.*) **1** The inner layer of cells of an animal embryo; the term is usually applied to the primitive germ-layer of cells while they are still clearly marked and before tissues develop. The gut and its associated glands develop from endoderm. **2** The inner layer of cells of a diploblastic animal. —***endodermal*** (*adj.*) ↑ ECTODERM

CJ010 mesoderm (*n.*) The middle layer of cells of a triploblastic animal embryo; the term is usually applied to the primitive germ-layer of cells while still clearly marked and before tissues develop. Muscles, blood, cartilage, connective tissue, etc., develop from mesoderm. —***mesodermal*** (*adj.*) ↑ ECTODERM

CJ011 parietal mesoderm The part of the mesoderm near the ectoderm from which the muscle layers of the gut, the outer layers of coelomic epithelium, and the blood vessels, all develop. ↑ ECTODERM

CJ012 visceral mesoderm The part of the mesoderm near the endoderm. The inner layers of coelomic epithelium and the visceral muscles develop from this part of the germ layer. ↑ ECTODERM

CJ013 coelom (*n.*) The main cavity in the body of many triploblastic animals in which the gut is suspended. In some animals it forms all the body cavity; in arthropods and molluscs it is reduced to the cavity containing the sex organs and excretory organs only; in vertebrates it is the abdominal cavity. The coelom in many lower animals is important in collecting excretions and passing them to the exterior through ducts in the walls of the coelom. The coelom is situated in the mesoderm and lined with epithelium. Fluid contained in the coelom is not circulated by muscular walls. —COELOMATE (*n*) COELOMIC (*adj.*) ↓ SECONDARY BODY CAVITY · COELOMIC SPACE · PERIVISCERAL CAVITY · PERITONEAL CAVITY · PLEURAL CAVITY[2] · PERITONEUM · PLEUROPERITONEUM · SEROUS MEMBRANE[2] ↑ METAZOA

CJ014 secondary body cavity (*n.*) Alternative term for COELOM.

CJ015 coelomic space (*n.*) The cavities in the mesoderm, *e.g.* the pericardial, perivisceral, peritoneal, and pleural cavities, in vertebrates. ↑ COELOM → PRIMARY BODY CAVITY · HAEMOCOEL · PERICARDIAL CAVITY

CJ016 perivisceral cavity (*n*) The main body cavity of most triploblastic animals, (absent in Platyhelminthes and Nemertea). Organs are suspended in the cavity which is bounded by the body wall. The cavity contains fluid and may develop in one of three ways, ***a*** from coelom (vertebrates, earth worms); ***b*** from haemocoel (arthropods); ***c*** from intercellular spaces forming a fluid-filled cavity (nematodes) ↑ COELOM

CJ017 peritoneal cavity (*n.*) **1** (In mammals) part of the coelom posterior to the diaphragm; it contains the liver, kidneys, spleen, and all the gut posterior to the stomach. **2** (In other vertebrates) an alternative term for the PERIVISCERAL CAVITY. ↑ COELOM

CJ018 pleural cavity[2] (*n.*) (In mammals) part of the coelom anterior to the diaphragm; it contains a lung. A pair of pleural cavities are separated from each other by the pericardial cavity and the mediastinum; they are separated from the peritoneal cavity by the diaphragm. ↑ COELOM → MESENTERY

CJ019 peritoneum (*n.*) The serous membrane lining the peritoneal or perivisceral cavity. It is folded round the surface of viscera in the cavity, forming a mesentery which supports the viscera. —PERITONEAL (*adj.*) PERITONITIS (*n.*) ↑ COELOM → MESENTERY

CJ020 pleuroperitoneum (*n.*) (In vertebrates other than mammals) a serous membrane lining the pleuroperitoneal cavity. The coelom of these vertebrates consists of a pleuroperitoneal cavity and a pericardial cavity. —***pleuroperitoneal*** (*adj.*) ↑ COELOM

CJ021 serous membrane[2] (*n.*) (In vertebrates) the mesothelium and underlying connective tissue lining the perivisceral, peritoneal, pericardial, and pleural cavities. ↑ COELOM → SEROUS

CJ022 peritonitis (*n.*) Inflammation of the peritoneum. ↑ METAZOA

CJ023 diploblastic (*adj.*) **1** Having a body wall of two layers of cells; the layers are ectoderm and endoderm. The two layers are separated by a jelly-like substance, the mesogloea. **2** Having two germ-layers in the embryo. ↓ TRIPLOBLASTIC · COELOMIC · COELOMATE[1] · ACOELOMATE[1] ↑ METAZOA

CJ024 triploblastic (*adj.*) **1** Having a body developed from three germ-layers; ectoderm, mesoderm, and endoderm. All metazoa, except for coelenterates, are triploblastic animals. **2** Having three germ layers in the embryo. ↑ DIPLOBLASTIC

CJ025 coelomic (*adj.*) Of or to do with a coelom, *e.g.* coelomic fluid. ↑ DIPLOBLASTIC

CJ026 coelomate[1] (*adj.*) Possessing a coelom. ↓ ACOELOMATE[1] (1) ↑ DIPLOBLASTIC

CJ027 acoelomate[1] (*adj.*) Describes an animal not possessing a true coelom, *e.g.* platyhelminthes are acoelomate—they have no true body cavity. ↑ DIPLOBLASTIC

CJ028 perivisceral (*adj.*) Describes a structure surrounding the viscera. ↓ PERITONEAL ↑ VISCUS · METAZOA

CJ029 peritoneal (*adj.*) Of or to do with the peritoneum. ↑ PERIVISCERAL

CJ030 viscus (*n.,pl.* **viscera**) Any organ in the abdominal or thoracic cavities, *e.g.* the heart, lung, liver, kidney or intestine. —EVISCERATE (*v.*) VISCERAL (*adj.*) ↓ ORGAN[2] · THORAX[1] · ABDOMEN[1] · COELOMIC FLUID · ORGANOLOGY · EVISCERATE · VISCERAL ↑ METAZOA

CJ031 organ[2] (*n.*) A part of an organism which is both a structural and a functional unit; it is composed of various tissues, including connective tissue, *e.g.* ***a*** the heart; ***b*** a kidney; ***c*** the stomach; ***d*** a lung. ↓ SYSTEM[4] ↑ VISCUS

CJ032 system[4] (*n.*) All the structures in the body of a multicellular organism concerned with one particular function of the organism. A system in an animal consists of one or more organs interconnected by tubes, ducts, or sinuses, *e.g.* ***a*** the respiratory system of a tetrapod vertebrate (the lungs and associated tubes and sinuses); ***b*** the circulatory system of an arthropod (heart, haemocoel, sinuses, and tubes); ***c*** the vascular system of a plant. —SYSTEMIC (*adj.*) ↑ ORGAN[2]

CJ033 viscera (*n.pl.*) The plural of VISCUS. ↑ ORGAN[2] · VISCUS

CJ034 thorax[1] (*n.*) (In terrestrial vertebrates) the region of the body containing the heart and lungs, *i.e.* the upper part of the trunk. In mammals, the thorax is separated from the abdomen by a diaphragm, but the two regions are not separated in other vertebrates. The thorax is anterior to the abdomen. —***thoracic*** (*adj.*) ↓ MESENTERY · VENTER[1] ↑ VISCUS

CJ035 abdomen[1] (*n.*) (In terrestrial vertebrates) the region of the body containing viscera other than the heart or lungs (*e.g.* intestines, kidneys, liver, etc.). In mammals, the diaphragm separates the abdomen from the thorax. The abdomen is posterior to the thorax. —***abdominal*** (*adj.*) ↓ MESENTERY ↑ VISCUS

CJ036 mesentery (*n.*) **1** (In vertebrates) sheets of thin connective tissue by which the stomach and intestines are suspended from the dorsal wall of the abdominal cavity. **2** The tissues supporting the intestines; the mesenteries carry blood, lymph vessels and nerves to the organs of the alimentary canal. **3** (In complex coelenterates such as sea-anemones and corals) vertical partitions of the coelenteron. —***mesenteric*** (*adj.*) ↑ ABDOMEN[1]

CJ037 venter[1] (*n.*) **1** The abdomen. **2** The ventral surface of the abdomen in animals, or the anterior surface of the abdomen in man. **3** Any protuberance shaped like the abdomen. —VENTRAL (*adj.*) ↓ ABDOMEN[1]

CJ038 coelomic fluid (*n.*) The colourless liquid contained in a coelom; it is not circulated by muscular action of the containing walls. The liquid contains isolated coelomic corpuscles and plays a part in removing excreta. ↓ COELOMIC CORPUSCLES · HAEMOLYMPH ↑ VISCUS → NEPHRIDIUM

CJ039 coelomic corpuscles (*n.pl.*) (In annelids) the term includes amoebocytes and other cells, such as fat-storing cells. The corpuscles are all solitary cells and many exhibit amoeboid movement. ↑ COELOMIC FLUID → AMOEBOCYTE · PHAGOCYTE

CJ040 haemolymph (*n.*) (In some invertebrates) the coelomic liquid which is regarded as carrying out the functions of blood and lymph in vertebrates. ↑ COELOMIC FLUID

CJ041 organology (*n.*) The study of the structure and functions of organs. ↑ VISCUS → CYTOLOGY · HISTOLOGY · ANATOMY · PHYSIOLOGY

CJ042 eviscerate (*v.t.*) To remove the viscera from a body, particularly the viscera from the abdominal cavity. ↑ VISCUS → EGEST

CJ043 visceral (*adj.*) Of, or to do with, or situated in, the viscera, *e.g.* the visceral branch of the vagus nerve supplies the viscera. ↓ COELIAC · SPLANCHNIC ↑ VISCUS → PARIETAL (An)

CJ044 coeliac (*adj.*) Of or to do with the abdominal cavity, *e.g.* coeliac arteries. To distinguish **coeliac** and **visceral**: the coeliac artery arises from the aorta and divides into three visceral arteries (gastric, hepatic, and splenic), *i.e.* a visceral artery supplies a viscus; a coeliac artery is situated in the abdominal cavity. ↑ VISCERAL

CJ045 splanchnic (*adj.*) Of or to do with the viscera; the term applies to the respiratory, digestive, urogenital, and endocrine-gland systems, *e.g.* splanchnic nerves innervate organs of these systems. To contrast **splanchnic** and **visceral**: the visceral branch of the vagus nerve is a splanchnic nerve, *i.e.* visceral describes the location of the nerve, and splanchnic implies its function; splanchnic is not used to indicate the situation of a structure. ↑ VISCERAL → SOMATIC (An)

CJ046 soma (*n.*) The body of an animal or of a plant, considered as a whole, but excluding germ-cells. —SOMATIC (*adj.*) ↓ SEGMENTATION[1] · COELENTERATE · AUTOTOMY · DEGENERATE[3] · SEGMENTAL · SOMATIC · ULTIMATE[2] ↑ METAZOA

CJ047 segmentation[1] (*n.*) The repetition of a number of similar features of the main systems of an animal along its midline, or along the axis of an appendage; the pattern of symmetry of organs and of structures are the main features. Segmentation is most noticeable in annelids and arthropods, where each of the visible external rings marks a segment; each segment contains a similar arrangement of blood vessels, nerves, excretory organs, and epidermal structures. Not all annelid segments are perfectly similar; those at the anterior end and posterior end differ in some structures. In vertebrates, segmentation is limited to parts of the nervous, muscular, and skeletal, systems, and is properly called **metamerism**; clearer segmentation is observable in vertebrate embryos. ↓ METAMERISM (Sn) · SEGMENT · METAMERE · SOMATOTYPE ↑ SOMA · METAZOA

CJ048 metamerism (*n.*) The condition of a body divided into a repeated pattern of similar structures; segmented animals exhibit metamerism. The system of spinal nerves in man exhibits metamerism, as it is the repetition of a regular pattern, although the actual body does not consist of segments each with a spinal nerve. —METAMERE (*n.*) METAMERIC, METAMERISED (*adj.*) ↑ SEGMENTATION[1] (Sn)

CJ049 segment (*n.*) (In animals) a clearly visible division of the body or an appendage, which is repeated along the midline or axis, *e.g.* annelids are divided into segments. —SEGMENTATION (*n.*) ↑ SEGMENTATION[1]

CJ050 metamere (*n.*) **1** One structure of a repeated pattern of similar structures along the midline of the body of an animal. **2** The region of the body containing the structure, *i.e.* a theoretical segment. A segment itself is also a metamere, *e.g.* a vertebra is a metamere of the vertebral column, as the vertebral column is a repeated pattern of similar structures. ↑ SEGMENTATION[1] · SEGMENT (H)

CJ051 somatotype (*n.*) The body type of an organism, in terms of measurement, *e.g.* tall or thin, short or fat. —***somatypical*** (*adj.*) ↑ SEGMENTATION[1]

CJ052 coelenterate (*n.*) A diploblastic animal with a coelenteron. ↓ COELOMATE[2] · ACOELOMATE[2] ↑ SOMA

CJ053 coelomate[2] (*n.*) A triploblastic animal with a true coelom. ↑ COELENTERATE

CJ054 acoelomate[2] (*n.*) A triploblastic animal with no true coelom. ↑ COELENTERATE

CJ055 autotomy (*n.*) Self amputation of a part of the body when it is seized by a predator or is in danger, *e.g.* ***a*** the limbs of many arthropods have a weak point at which they break; ***b*** the tail of a lizard breaks off when muscles snap a vertebra—the amputated part is usually regenerated. ↑ SOMA

CJ056 degenerate[3] (*v.i.*) **1** To change to a less complex structure or to a functionally less active form. **2** To go backwards in development, usually because of the lack or loss of functional use, *e.g.* in man the tail has degenerated into the coccyx. ↓ REGENERATE ↑ SOMA → EVOLVE[3] (An)

CJ057 regenerate (*v.i.*)To renew, or grow again, a part of the body which has been damaged or lost, *e.g.* ***a*** if a nerve is cut, the receptor or effector is useless; the nerve grows again from the cell body to the terminal end, and thus regenerates itself; ***b*** if a starfish loses a limb, the limb grows again, *i.e.* it is regenerated. —REGENERATION (*n.*) ↑ DEGENERATE[3]

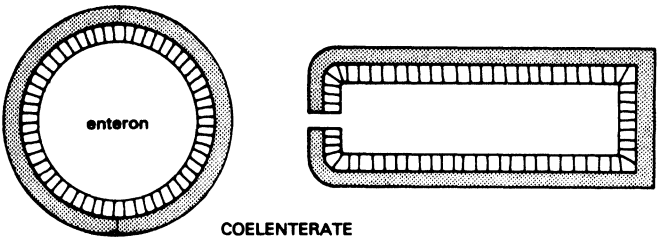
CJ058 segmental (*adj.*) Of, or to do with, or in the form of, a segment, *e.g.* the segmental structure of an earthworm. ↓ SEGMENTED · METAMERIC · METAMERIZED ↑ SOMA

CJ059 segmented (*adj.*) Describes an animal body or appendage consisting of or marked by segments, *e.g.* a caterpillar is segmented. ↑ SEGMENTAL

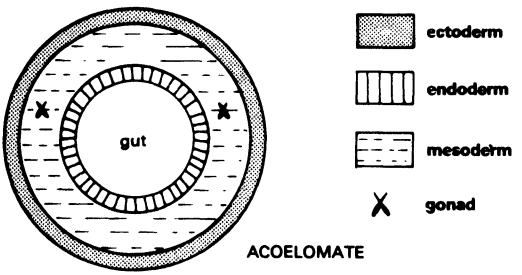
CJ060 metameric (*adj.*) Of or to do with metamerism, *e.g.* the metameric structure of the spinal nerves. ↑ SEGMENTAL

CJ061 metamerized (*adj.*) Describes the body of an animal which contains metameres, or can be theoretically visualized as split into metameres, *e.g.* the vertebral column is metamerized. ↑ SEGMENTAL

CJ062 somatic (*adj.*) Of or to do with any



COELENTERATE



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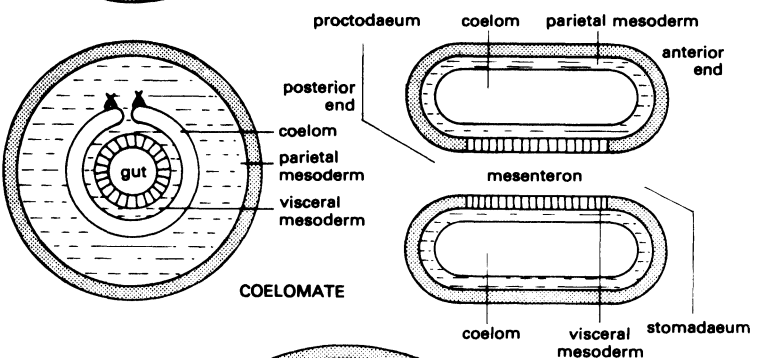

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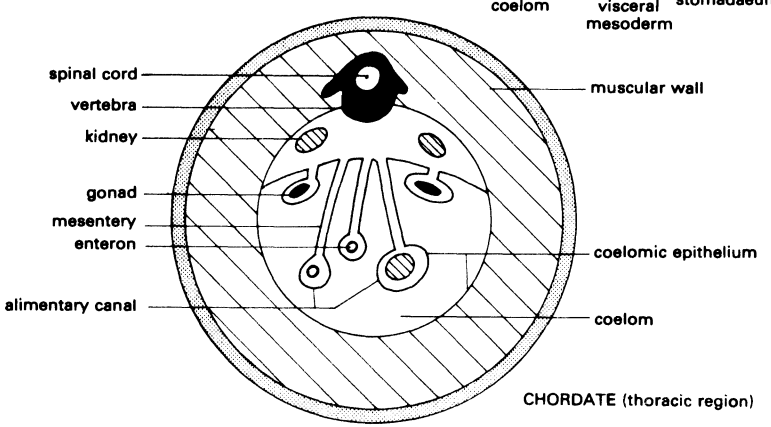


CHORDATE (thoracic region)

part of the body except the viscera (including germ-cells), *e.g.* ***a*** somatic cells are those cells of an organism other than germ-cells; ***b*** somatic tissue is body tissue other than that of the viscera or blood vessels. ↑ SOMA → SPLANCHNIC (An)

CJ063 ultimate[2] (*adj.*) **1** The last or furthest portion, section, or segment, of a structure which is divided into or possesses clearly defined parts, *e.g.* the anus of an earthworm is situated in the ultimate segment. To contrast **terminal** and **ultimate**: the terminal bud on a branch (the bud at the end of the branch); the ultimate cell of a hyphal crosier (the last cell of a structure composed of cells). **2** The last part, result, or effect, beyond which there can be no other, *e.g.* the ultimate effect of reacting concentrated sulphuric acid with most organic compounds is a charred mass of carbon (no further reaction can take place). ↓ PENULTIMATE ↑ SOMA → TERMINAL[1]

CJ064 penultimate (*adj.*) The portion, section, or segment, next to the ultimate one, *i.e.* the last but one, *e.g.* the penultimate segment of an insect's leg is the tibia. ↑ ULTIMATE[2]

CJ065 trunk[2] (*n.*) **1** The main part of the body, containing the viscera of a vertebrate. **2** (G.S.) The proboscis of an elephant. ↓ APPENDAGE (An) · FOREARM · HIP · CHEEK[1] · HIND · APPENDICULAR ↑ METAZOA → THORAX[2] · PROBOSCIS

CJ066 appendage (*n.*) A projection, of varying size, from the main axial trunk or body of an animal, *e.g.* ***a*** arms and legs are appendages of vertebrates; ***b*** antennae of insects, and pincers of crabs, are appendages. —APPENDICULAR (*adj.*) ↑ TRUNK[2] (An)

CJ067 limb (*n.*) A vertebrate appendage derived from the pentadactyl limb, *e.g.* an arm, a leg, or a wing. —***limbed, limbless*** (*adj.*) ↑ APPENDAGE → PENTADACTYL LIMB

CJ068 forearm (*n.*) The lower part of the human arm, between the elbow and the wrist; an arm consists of the upper arm and the forearm. ↓ ELBOW · PALM · THUMB ↑ TRUNK[2]

CJ069 elbow (*n.*) The joint between the shoulder and the wrist. ↑ FOREARM

CJ070 palm (*n.*) The inner surface of a human hand; it is closed when the fingers meet over it. ↑ FOREARM

CJ071 thumb (*n.*) The human digit which is in opposition to the four fingers of the hand. ↑ FOREARM

CJ072 hip (*n.*) The joint at which a hind leg is attached to the body or trunk. ↓ THIGH · BUTTOCK · SHIN · CALF · HEEL · SOLE[2] · TOE ↑ TRUNK[2]

CJ073 thigh (*n.*) The part of the human leg between the hip and the knee. ↑ HIP

CJ074 buttock (*n.*) A rounded, muscular or fleshy part of a biped body, posterior to the hip; there is a buttock on either side of the anus. ↑ HIP

CJ075 shin (*n.*) The hard bony part in the front of the lower part of the human leg. ↑ HIP

CJ076 calf (*n.*) The fleshy part at the back of the lower part of a human leg. ↑ HIP

CJ077 heel (*n.*) The rounded proximal end of the human foot, *i.e.* the end of the foot below the leg. ↑ HIP

CJ078 sole[2] (*n.*) The underneath part of the human foot, between the heel and the toes. ↑ HIP

CJ079 toe (*n.*) One of the digits on the human foot, or on any of the four legs of a mammalian tetrapod. The innermost digit is called the **big toe**. ↑ HIP

CJ080 cheek[1] (*n.*) **1** (In mammals) the fleshy wall of the mouth, situated in front of and ventral to the eye, on either side of the nose. **2** (In other animals) the side part of the head. ↓ SCALP ↑ TRUNK[2]

CJ081 scalp (*n.*) The skin and subcutaneous tissues of the head; hair grows from the scalp. ↑ CHEEK[1]

CJ082 hind (*adj.*) Describes the region, or the structures, at the posterior end of an animal, *e.g.* the hind limbs are the posterior pair of vertebrate appendages. ↓ FORE (P) ↑ TRUNK[2]

CJ083 fore (*adj.*) Describes the region or limbs at the anterior end of an animal, *e.g.* the fore-quarters are the region of the shoulder. ↑ HIND (P)

CJ084 appendicular (*adj.*) Of or to do with appendages. In descriptions of skeletons, appendicular contrasts with **axial**. ↓ PALMAR ↑ TRUNK[2] → AXIAL (An)

CJ085 palmar (*adj.*) Of or to do with the palm of the hand. ↑ APPENDICULAR

Skeletal Anatomy

CK001 skeleton (*n.*) The framework of hard tissue which supports, protects and gives shape and rigidity to the bodies of animals; it also provides an anchorage for muscles. In structure it is either an exoskeleton or an endoskeleton. —***skeletal*** (*adj.*) ↓ EXOSKELETON · SKELETAL · AXIAL SKELETON · NEURAL ARCH · RIB · SKULL · APPENDICULAR SKELETON · HUMERUS · FEMUR[1] → JOINT[2] · PECTORAL GIRDLE · PELVIC GIRDLE · TAGMA · ANATOMICAL TERMS

CK002 exoskeleton (*n.*) A skeleton covering the body, or situated in the skin; it is usually composed of substances secreted by the epidermal cells, *e.g.* ***a*** the hard covering of chitin, found in insects; ***b*** the calciferous

carapace of crabs; *c* the calciferous shell of molluscs; *d* the bony plates of a tortoise, beneath its skin. ↓ ENDOSKELETON (An) · VERTEBRATE[1] · INVERTEBRATE · CHORDATE · TETRAPOD ↑ SKELETON

CK003 endoskeleton (*n.*) A skeleton situated inside the body of an animal. In vertebrates, it is a series of bones or cartilages, each articulating with or joined to its neighbour. Animals possessing an endoskeleton may also have an exoskeleton formed by secretions of cells situated in folds of epidermis extending into the body, *e.g.* the exoskeleton of a turtle, an animal with a vertebrate endoskeleton. ↑ EXOSKELETON → BONE · CARTILAGE · EPIDERMIS[2]

CK004 vertebrate[1] (*n.*) An animal possessing a backbone (vertebral column); the term includes fishes, amphibians, reptiles, birds and mammals. All vertebrates have an endoskeleton. —VERTEBRATE (*adj.*) ↑ EXOSKELETON → VERTEBRAL COLUMN · AMNIOTE

CK005 invertebrate (*n.*) A collective name for all animals which are not vertebrates; the term includes unicellular animals, such as amoeba, as well as sponges, hydroids, annelids, arthropods, starfishes, sea-squirts, etc. Invertebrates may possess an exoskeleton, but the smaller invertebrates often possess no skeleton at all. ↑ EXOSKELETON → COELENTERATE (H)

CK006 chordate (*n.*) An animal with a notochord (at least in the embryonic stage), a hollow dorsal nerve chord, and gillslits; the term includes vertebrates and protochordates. ↑ EXOSKELETON

CK007 tetrapod (*n.*) An animal with two pairs of pentadactyl limbs; the term includes amphibians, reptiles, birds and mammals. ↑ EXOSKELETON → PENTADACTYL LIMB · QUADRUPED · BIPED

CK008 skeletal (*adj.*) Of or to do with the skeleton, *e.g.* skeletal muscles are those attached to bones of the skeleton. ↓ SKELETOGENOUS ↑ SKELETON

CK009 skeletogenous (*adj.*) The parts or structures of an embryo which develop into the cartilage and bone of an endoskeleton. ↑ SKELETAL

CK010 axial skeleton (*n.*) The part of the skeleton consisting of the skull, the vertebral column, the ribs, and the sternum. ↓ VERTEBRAL COLUMN · SACRUM · VERTEBRA · VERTEBRARTERIAL CANAL · SPINA BIFIDA · VERTEBRAL · LUMBAR ↑ SKELETON → SKULL · RIB · STERNUM[2]

CK011 vertebral column (*n.*) A flexible column of jointed bones which gives the chief support for the body of higher animals, *i.e.* those with endoskeletons, and protects the major tract of nerves (spinal cord) in the body. The individual bones are called **vertebrae.** ↓ BACKBONE · SPINE[2] · INTERVERTEBRAL DISCS ↑ AXIAL SKELETON

CK012 backbone (*n.*) An alternative term for VERTEBRAL COLUMN.

CK013 spine[2] (*n.*) An alternative term for VERTEBRAL COLUMN.

CK014 intervertebral discs (*n.pl.*) The thin plates of fibro-cartilage, situated between centra of vertebrae; they prevent jarring between the vertebrae. ↑ VERTEBRAL COLUMN

CK015 sacrum (*n.*) The vertebra (in amphibians) or the vertebrae (in amniotes) which support the pelvic girdle. In amniotes, it consists of a group of two or more vertebrae fused together; in amphibians, it is the ninth vertebra. —***sacral*** (*adj.*) ↓ COCCYX · UROSTYLE ↑ AXIAL SKELETON → SACRAL RIB

CK016 coccyx (*n.,pl.* **coccyges**) The terminal vertebrae, beyond the sacrum, that are fused together; it is the vestige of the caudal vertebrae. In man, it consists of 3 to 5 fused vestigial vertebrae. —***coccygeal*** (*adj.*) ↑ SACRUM

CK017 urostyle (*n.*) (In amphibians) the unsegmented, long, caudal portion of the vertebral column; it consists of a rod of bone tapering to a fine point. ↑ SACRUM

CK018 vertebra (*n.,pl.* **vertebrae**) A bony or cartilaginous segment of a longitudinally arranged chain of segments near the dorsal side of an animal. A vertebra surrounds a portion of the spinal cord, and articulates with the vertebrae on each side of it, *i.e.* at the anterior (superior) and posterior (inferior) ends. The vertebrae are developed from somites in the embryo, and replace the notochord partially or in full. The midpoint in the length of each vertebra in an adult is level with the interval between two successive somites in the embryo. A symphysis between two successive vertebrae allows a small relative movement, forming the flexible nature of the vertebral column. In fishes, all vertebrae are similar; in amphibians, the first vertebra differs from the remainder. Amniotes possess cervical, thoracic, lumbar, sacral, and caudal vertebrae. In each class of animals, modifications occur in the number of each type of vertebra. —VERTEBRATE (*n.*) VERTEBRAL, VERTEBRATE (*adj.*) ↓ CENTRUM · ATLAS · AXIS[1] · ODONTOID PROCESS ↑ AXIAL SKELETON → SOMITES · NOTOCHORD · SYMPHYSIS

CK019 centrum (*n.,pl.* **centra**) The main body, or massive part, of a vertebra; it replaces the notochord of an embryo, with partial replacement in fishes, almost complete replacement in amphibians and complete replacement in amniotes. It lies ventral to the spinal cord, and is connected to neighbouring centra by collagen fibres; it is separated from them by intervertebral discs. Neural, and often haemal, arches arise from it. ↑ VERTEBRA → NOTOCHORD

CK020 atlas (*n.*) (In tetrapods) the first vertebra of the backbone; it is modified to articulate with the occipital condyles of the cranium. It is a simple bony ring with almost no centrum, but with a large neural canal, and broad, flat, transverse processes. The occipital condyles fit into two large hollows on the atlas, and allow an up and down

movement of the skull. —***atlantal*** (*adj.*) ↑ VERTEBRA

CK021 axis[1] (*n.*) (In amniotes) the second vertebra of the backbone; it has a large odontoid process situated ventrally. The odontoid process projects into the bony ring of the atlas, and is separated from the spinal cord by a ligament. The atlas rotates about the odontoid process, allowing rotation of the skull. (In amphibia, the second vertebra is similar to the next successive vertebrae.) —AXIAL (*adj.*) ↑ VERTEBRA

CK022 odontoid process (*n.*) See **axis**[1] (↑).

CK023 vertebrarterial canal (*n.*) A canal in cervical vertebrae formed by foramina in the transverse processes and cervical ribs, for the passage of the vertebral artery. ↑ AXIAL SKELETON

CK024 spina bifida (*n.*) A congenital malformation of the spine in which the spinal cord emerges through a parting in the vertebral column and causes a swelling in the back. ↑ AXIAL SKELETON

CK025 vertebral (*adj.*) Of, to do with, or situated near a vertebra. ↓ VERTEBRATE[2] ↑ AXIAL SKELETON

CK026 vertebrate[2] (*adj.*) Possessing vertebrae. ↑ VERTEBRAL

CK027 lumbar (*adj.*) (In a vertebrate) describes the waist region, *i.e.* below the thorax but above the pelvis. ↓ SACRAL · AMPHICOELUS · PROCOELUS ↑ AXIAL SKELETON

CK028 sacral (*adj.*) Of or to do with the sacrum. ↑ LUMBAR

CK029 amphicoelus (*adj.*) (Of vertebrae) having a centrum with both surfaces concave. ↑ LUMBAR

CK030 procoelus (*adj.*) (Of vertebrae) having the anterior surface concave; the posterior surface is usually convex. ↑ LUMBAR

CK031 neural arch (*n.*) An arch of bone based on the dorsal side of the centrum of a vertebra. The neural arches of the vertebra form the neural canal for the spinal cord. ↓ VERTEBRAL ARCH · ZYGAPOPHYSIS · TRANSVERSE PROCESS · HAEMAL ARCH ↑ SKELETON → NEURAL CANAL

CK032 vertebral arch (*n.*) Alternative term for NEURAL ARCH. ↓ NEURAL PLATE[2] · NEURAL SPINE · VERTEBRAL FORAMEN · NEURAPOPHYSIS ↑ NEURAL ARCH

CK033 neural plate[2] (*n.*) One of the two lateral bones forming the neural arch. ↑ VERTEBRAL ARCH

CK034 neural spine (*n.*) A median, dorsal, projection from the neural arch. ↑ VERTEBRAL ARCH

CK035 vertebral foramen (*n.*) (In man) an alternative term for NEURAL CANAL (→). ↑ VERTEBRAL ARCH

CK036 neurapophysis (*n.*) Alternative term for NEURAL PLATE[2] (↑).

CK037 zygapophysis (*n.*,*pl.* **zygapophyses**) One of the four small projections in a dorsal direction, on the anterior and posterior (superior and inferior) surfaces of the neural arch. There are two anterior and two posterior zygapophyses on each vertebra, one on the left, and one on the right. The zygapophyses of one vertebra articulate with those of the two adjacent vertebrae and limit the rotational and bending movements of the vertebral column. —***zygapophyseal*** (*adj.*) ↓ PREZYGAPOPHYSIS · POSTZYGAPOPHYSIS · METAPOPHYSIS ↑ NEURAL ARCH

CK038 prezygapophysis (*n.*) An alternative term for ANTERIOR (superior) ZYGAPOPHYSIS; it articulates with the postzygapophysis of the neighbouring vertebra. ↑ ZYGAPOPHYSIS

CK039 postzygapophysis (*n.*) An alternative term for POSTERIOR (inferior in humans) ZYGAPOPHYSIS. ↑ ZYGAPOPHYSIS

CK040 metapophysis (*n.*) (In lumbar vertebrae) one of a pair of projections, extensions on a prezygapophysis, in a dorsal and anterior direction; it bears the prezygapophysis on its posterior side. ↑ ZYGAPOPHYSIS

CK041 transverse process (*n.*) A lateral projection from a side of the neural arch; there is one on each side of a vertebra. In thoracic vertebrae, the ribs articulate with the transverse processes. ↓ ANAPOPHYSIS ↑ NEURAL ARCH

CK042 anapophysis (*n.*) (In lumbar vertebrae) a small projection arising dorsally near a transverse process. ↑ TRANSVERSE PROCESS

CK043 haemal arch (*n.*) (In the caudal vertebrae of fish, snakes, and some other vertebrates) an arch of bone, or cartilage, arising ventrally from the centrum; it provides protection for the caudal artery and caudal vein. ↓ HAEMAPOPHYSIS · HAEMAL SPINE · HYPAPOPHYSIS ↑ NEURAL ARCH

CK044 haemapophysis (*n.*) One of the two processes which form the haemal arch. ↑ HAEMAL ARCH

CK045 haemal spine (*n.*) A spinous projection from the ventral point of the haemal arch. ↑ HAEMAL ARCH

CK046 hypapophysis (*n.*) **1** (In lumbar vertebrae) a projection, in a posterior direction, on the median ventral side of the centrum. **2** Alternative term for HAEMAL SPINE. ↑ HAEMAL ARCH

CK047 rib (*n.*) (In terrestrial vertebrates) a flattened curved bone articulating with the vertebral column at one end, either connected to the sternum or free at the other end; it partially encircles and protects the thoracic cavity. The ribs are connected by intercostal muscles. ↓ TRUE RIB · RIB-CAGE · TUBERCULUM[2] · COSTAL ↑ SKELETON → INTERCOSTAL MUSCLE

CK048 true rib (*n.*) (In amniotes) a rib attached to the vertebral column and to the sternum; in mammals there are seven true ribs. ↓ FALSE RIB · FLOATING RIB · SACRAL RIB ↑ RIB

CK049 false rib (*n.*) A rib attached to the vertebral column and to the posterior true rib. ↑ TRUE RIB

CK050 floating rib (*n.*) A rib not attached to the sternum, or to the posterior true rib; it is free at its distal end. ↑ TRUE RIB

CK051 sacral rib (*n.*) A rib attached to one of the sacral vertebrae; in reptiles, sacral ribs provide articulating surfaces for the pelvic girdle; in mammals, they are much reduced and fused to the pelvis. ↑ TRUE RIB

CK052 rib-cage (*n.*) The ribs, together with the sternum and the vertebral column, form a skeletal cage enclosing the thorax; this is the rib-cage. Expansion of the rib-cage, by muscular effort, expands the thorax for respiratory movement. ↑ RIB → STERNUM

CK053 tuberculum² (*n.*) An outgrowth on a rib which articulates with the transverse process of a vertebra; it is near the proximal end of the rib. ↓ TUBERCLE² ↑ RIB → TUBERCULUM¹

CK054 tubercle² (*n.*) Alternative term for TUBERCULUM².

CK055 costal (*adj.*) Of or to do with the ribs. ↑ RIB

CK056 skull (*n.*) The part of the skeleton consisting of the cranium and the facial skeleton; the latter includes, **a** the sense capsules; **b** the jaws, the hyoid bone, and the cartilages of the larynx. The skull may also be divided into the **neurocranium** and the **viscerocranium.** ↓ CRANIUM · SENSE CAPSULES · ZYGOMATIC ARCH · OCCIPUT¹ → SKELETON

CK057 cranium (*n.,pl.* **cranía**) The domed, bony case, composed of several bones joined by sutures; it encloses and protects the brain. —CRANIAL (*adj.*) ↓ NEUROCRANIUM · VISCEROCRANIUM · SPLANCHNOCRANIUM ↑ SKULL → SUTURE

CK058 neurocranium (*n.,pl.* **neurocrania**) The bony and cartilaginous case which encloses the brain and contains the sense capsules. —***neurocranial*** (*adj.*) ↑ CRANIUM

CK059 viscerocranium (*n.,pl.* ***viscerocrania***) The bones comprising the upper and lower jaws and their attachments. —***viscerocranial*** (*adj.*) ↑ CRANIUM → MANDIBLE

CK060 splanchnocranium (*n.*) Alternative term for VISCEROCRANIUM. ↑ CRANIUM

CK061 sense capsules (*n.pl.*) The olfactory, auditory and optic capsules. ↓ OLFACTORY CAPSULE · OPTIC CAPSULE · LACRIMAL¹ ↑ SKULL → AUDITORY CAPSULE

CK062 olfactory capsule (*n.*) The capsule containing the bones forming the nasal chamber. ↑ SENSE CAPSULES → NOSE

CK063 optic capsule (*n.*) The capsule consisting of the orbit and the lacrimal. ↑ SENSE CAPSULES → ORBIT¹

CK064 lacrimal¹ (*n.*) A small bone in the anterior (or superior) wall of the orbit; it is perforated by a small canal for the lacrimal duct. ↑ SENSE CAPSULES → LACRIMAL DUCT

CK065 lachrymal¹ (*n.*) Alternative spelling for LACRIMAL¹.

CK066 zygomatic arch (*n.*) A flat bar of bone forming the bony arch of the cheek, it joins the facial and cranial regions of the skull, and forms the lower edge of the orbit. ↓ ZYGOMA · VOMER ↑ SKULL

CK067 zygoma (*n.*) Alternative term for the ZYGOMATIC ARCH.

CK068 vomer (*n.*) A bone in the nasal region, partly forming the division between the nostrils in amniotes. —***vomerine*** (*adj.*) ↑ ZYGOMATIC ARCH

CK069 occiput¹ (*n.*) (In vertebrates) a general region of the skull near to the articulation between cranium and vertebral column. —***occipital*** (*adj.*) ↓ OCCIPITAL BONES · OCCIPITAL CONDYLE ↑ SKULL

CK070 occipital bones (*n.pl.*) The four bones forming the dorsal part of the cranium. ↑ OCCIPUT¹

CK071 occipital condyle (*n.*) A rounded knob of bone on one of the occipital bones; it articulates with the first vertebra (atlas). There is an occipital condyle on each side of the cranium. ↑ OCCIPUT¹ → ATLAS

CK072 appendicular skeleton (*n.*) The part of the skeleton consisting of the pectoral girdle, the pelvic girdle, and the four limbs. ↓ PENTADACTYL LIMB · PHALANGES · MANUS · PARAPLEGIA · PENTADACTYL · PRONE ↑ SKELETON → PECTORAL GIRDLE · PELVIC GIRDLE

CK073 pentadactyl limb (*n.*) A limb evolved as an adaptation to terrestrial life, not found in fishes, but found in all other vertebrates. The fore and hind limbs have the same basic structure, and each limb has three parts: an upper part with one long bone; a lower part with two long bones, more or less parallel; and a third part with many small bones terminating in five digits, some of which, in some species, have become vestigial. The pattern is modified in many species, with fusion of some of the elements, particularly the digits, but the same basic pattern is observable in a whale's flipper, a bird's wing, a horse's leg, and a man's arm. (See next page for diagram.) ↓ DIGIT · POLLEX · HALLUX

CK074 digit (*n.*) (In a pentadactyl limb) a terminal division; a toe or a finger. Five digits are present, some of which may be vestigial, *e.g.* in a horse, only one digit remains; the other four are vestigial. —***digital*** (*adj.*) ↑ PENTADACTYL LIMB

CK075 pollex (*n.*) The first digit on the innermost side of a fore limb; it corresponds to the thumb in man. ↑ PENTADACTYL LIMB

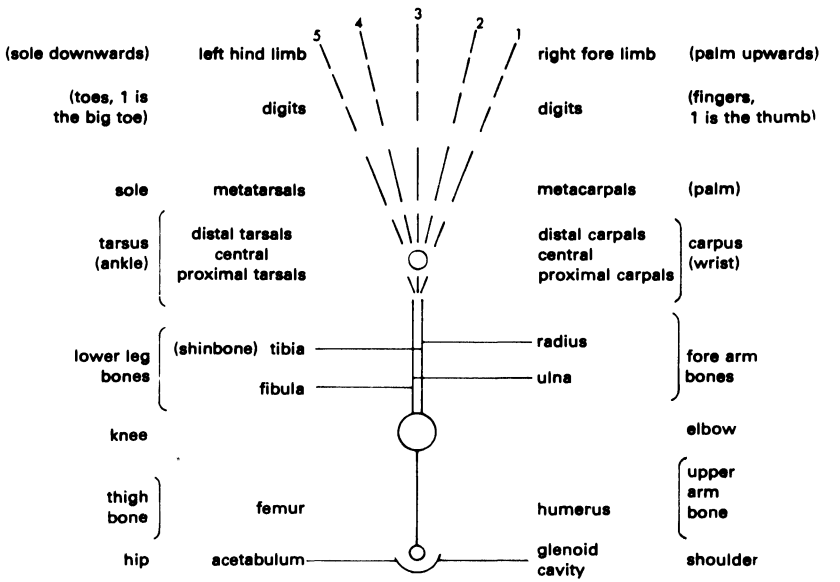
CK076 hallux (*n.*) The first digit on the innermost side of a hind limb; it corresponds to the big toe in man. ↑ PENTADACTYL LIMB

CK077 phalanges (*n.pl., sing.* **phalanx**) The bones in the digits in both fore and hind limbs of tetrapods. Each digit has one to five phalanges in a row, each articulating with its neighbours. The most proximal bone articulates proximally with a metacarpal or a metatarsal. ↓ CENTRAL · OS CENTRALE ↑ APPENDICULAR SKELETON

CK078 central (*n.*) A small bone situated between the proximal and distal rows of both the carpals and the tarsals. ↑ PHALANGES

CK079 os centrale (*n.*) Alternative term for CENTRAL (↑).

CK080 manus (*n.*) The terminal structure,



PENDTADACTYL LIMB (DIAGRAMMATIC)

including the digits, metacarpus and carpus, of the fore limb in tetrapods. The hand in man, and the equivalent structure in other terrestrial tetrapods. —***manual*** (*adj.*) ↓ PRONATION · SUPINATION · PRONATOR · SUPINATOR ↑ APPENDICULAR SKELETON

CK081 pronation (*n.*) The position in which the manus is turned through a right angle so that the ventral side (in the primitive position of limbs outstretched and pollux upright) is turned downwards, *i.e.* the normal position of the manus in quadrupeds; in this position the radius and ulna are crossed in man. Primates can turn the manus to this position and this action is also pronation. —PRONATOR (*n.*) PRONATE (*adj.*) ↑ MANUS ↓ SUPINATION (An)

CK082 supination (*n.*) (In primates) the action of turning the manus so that the palm, or ventral side, is facing upwards, with the arm outstretched; the opposite movement to pronation. The radius and ulna are untwisted in this movement. —SUPINATOR (*n.*) SUPINATE (*adj.*) ↑ MANUS · PRONATION (An)

CK083 pronator (*n.*) A muscle causing pronation. ↓ SUPINATOR (An) ↑ MANUS

CK084 supinator (*n.*) A muscle causing supination. ↑ MANUS · PRONATOR (An)

CK085 paraplegia (*n.*) Paralysis of the hind limbs, or of the body from the waist downwards. —***paraplegic*** (*adj.*) ↑ APPENDICULAR SKELETON

CK086 pentadactyl (*adj.*) Having five digits. —***pentadactylism*** (*n.*) ↓ PREAXIAL · POSTAXIAL ↑ APPENDICULAR SKELETON

CK087 preaxial (*adj.*) (In primitive vertebrates) the axis of a limb is at right angles to the vertebral column, with the palm, or sole, facing downwards; the anterior part of the limb in this position is the preaxial side. Anatomical descriptions of man assume the palm facing forward, arms at the side; the preaxial side is then the outer side of the arm. ↑ PENTADACTYL ↓ POSTAXIAL (P)

CK088 postaxial (*adj.*) The side opposite to the preaxial side of a limb. ↑ PENTADACTYL · PREAXIAL (P)

CK089 prone (*adj.*) (Of animals or structures) flat on or parallel to the ground, with the ventral side downwards. ↓ SUPINE (An) · PRONATE · SUPINATE ↑ APPENDICULAR SKELETON

CK090 supine (*adj.*) (Of animals or structures) flat on or parallel to the ground, with the dorsal side downwards. ↑ PRONE

CK091 pronate (*adj.*) Describes a manus in the position of pronation. ↑ PRONE

CK092 supinate (*adj.*) Describes a manus in the position of supination. ↑ PRONE

CK093 humerus (*n.*) (In vertebrates) the proximal bone of the fore limb, between the shoulder and the elbow. —***humeral*** (*adj.*) ↓ ULNA · CARPUS · METACARPUS · BICIPITAL GROOVE ↑ SKELETON

CK094 ulna (*n.*) (In vertebrates) one of the distal bones in the fore limb. In a quadruped, it is the posterior bone; in man, it is the inner bone when the palm faces forward. —***ulnar*** (*adj.*) ↓ RADIUS[1] · OLECRANON PROCESS · SIGMOID NOTCH · RADIOULNA ↑ HUMERUS

CK095 radius[1] (*n.*) One of the two distal bones in the fore limb; it is the anterior bone

in quadrupeds, and the outer bone in man when the palm faces forward. Its function is to allow the hand, or fore foot, to turn about its axis. —RADIAL (*adj.*) ↑ ULNA

CK096 olecranon process (*n.*) (In mammals) a bony process on the proximal end of the ulna; it extends beyond the elbow (or equivalent joint) and prevents further movement beyond straightening the fore limb. Muscles (extensors) are attached to the process. ↑ ULNA

CK097 sigmoid notch (*n.*) A deep groove on the ulna; it articulates with the trochlea of the humerus. ↑ ULNA → TROCHLEA

CK098 radioulna (*n.*) (In amphibians) the radius and ulna combined to form one bone. ↑ ULNA

CK099 carpus (*n.*) The region of tetrapod fore limb containing the carpals; it is approximately the wrist in man. —***carpal*** (*adj.*) ↓ CARPALS · CARPAL BONES ↑ HUMERUS → TETRAPOD

CK100 carpals (*n.pl.*) (In tetrapods) a group of small bones in the proximal part of the foot of the fore limb, comprising 10 to 12 bones (8 in man). On the proximal side they articulate with the radius and ulna; on the distal side they articulate with the metacarpals. The bones are arranged in two rows, the proximal carpals, and the distal carpals, with a bone between the rows. In man, the carpals approximate to the wrist. ↑ CARPUS

CK101 carpal bones (*n.pl.*) Alternative term for the CARPALS.

CK102 metacarpus (*n.*) The region of a tetrapod fore limb containing the metacarpals; in man, it is the palm of the hand. —***metacarpal*** (*adj.*) ↓ METACARPALS · METACARPAL BONES ↑ HUMERUS → TETRAPOD

CK103 metacarpals (*n.pl.*) The long cylindrical bones in the foot of the fore limb, one corresponding to each separate digit. On the proximal side they articulate with the carpals, on the distal side they articulate with the phalanges. In man, the metacarpals form the palm of the hand. —***metacarpal*** (*adj.*) ↑ METACARPUS

CK104 metacarpal bones (*n.pl.*) Alternative term for METACARPALS.

CK105 bicipital groove (*n.*) A groove on the proximal part of the humerus, close to the head; it is for the tendon of the biceps muscle. ↓ OLECRANON FOSSA ↑ HUMERUS

CK106 olecranon fossa (*n.*) A fossa just proximal to the trochlea, and posterior to it. ↑ BICIPITAL GROOVE → TROCHLEA

CK107 femur[1] (*n.*) (In vertebrates) the thigh bone; the proximal bone of the hind leg. —***femoral*** (*adj.*) ↓ TIBIA[1] · TARSUS[1] · METATARSUS · PATELLA ↑ SKELETON

CK108 tibia[1] (*n.*) (In vertebrates) the inner and larger bone of the leg forming the shin; one of the two distal bones of the hind limb. ↓ FIBULA · TROCHANTER[1] ↑ FEMUR[1]

CK109 fibula (*n.*) The outer and smaller of the two distal bones of the hind limb. —***fibular*** (*adj.*) ↑ TIBIA[1]

CK110 trochanter[1] (*n.*) (In vertebrates) a process on the proximal part of the femur; muscles are attached to it. In mammals, there are three trochanters. ↑ TIBIA[1]

CK111 tarsus[1] (*n.*) The region of tetrapod hind limb containing the tarsals; approximately the ankle in man. —***tarsal*** (*adj.*) ↓ TARSALS · TARSAL BONES · CALCANEUM · ASTRAGALUS · TALUS · FIBULARE ↑ FEMUR[1] → TETRAPOD

CK112 tarsals (*n.pl.*) (In tetrapods) a group of small bones in the proximal part of the foot of the hind limb, comprising 10 to 12 bones (7 in man). On the proximal side they articulate with the tibia and fibula, on the distal side they articulate with the metatarsals. The bones are arranged in two rows, the proximal tarsals and the distal tarsals, with a bone between the two rows. In man, the tarsals approximate to the ankle; one of the tarsals forms the heel. ↑ TARSUS[1]

CK113 tarsal bones (*n.pl.*) Alternative term for the TARSALS.

CK114 calcaneum (*n.*) A larger bone among the tarsals, the most proximal in man, forming the heel. It corresponds to the fibulare in other vertebrates. ↑ TARSUS[1]

CK115 astragalus (*n.*) A tarsal bone, distal to the calcaneum, articulating with the tibia; in man it forms the ankle. ↑ TARSUS[1] ↓ TALUS (Sn)

CK116 talus (*n.*) Alternative term for ASTRAGALUS.

CK117 fibulare (*n.*) The outer element of the proximal row of bones in the tarsus. ↑ TARSUS[1]

CK118 metatarsus (*n.*) The region of tetrapod hind limb containing the metatarsals; in man it is the sole of the foot. ↓ METATARSALS · METATARSAL BONES ↑ FEMUR[1] → TETRAPOD

CK119 metatarsals (*n.pl.*) The uneven-shaped bones in the foot of the hind limb, one corresponding to each separate digit. On the proximal side they articulate with the tarsals, on the distal side they articulate with the phalanges. In man, the metatarsals form the sole of the foot. —***metatarsal*** (*n.*) ↑ METATARSUS

CK120 metatarsal bones (*n.pl.*) Alternative term for METATARSALS.

CK121 patella (*n.*) (In some reptiles, birds and most mammals) a sesamoid bone, situated in the tendon of the extensor muscle, over the knee joint; it provides protection for the joint. ↓ KNEE-CAP · ACHILLES' TENDON ↑ FEMUR[1] → SESAMOID

CK122 knee-cap (*n.*) Alternative term for PATELLA.

CK123 Achilles' tendon (*n.*) (In mammals) the tendon from the heel to the muscles in the calf of the leg. ↑ PATELLA

CK124 joint[2] (*n.*) **1** A place where two parts or two structures unite, or are separated; especially a structure where two bones are linked, usually for the purpose of articulation. A joint may be fixed or movable, *e.g.* ***a*** the place where two pieces of wood are united is a fixed joint; ***b*** the place where the two parts of the leg link is a movable

joint, the knee. **2** An alternative term for a NODE. —***jointed*** (*adj.*) ↓ ARTICULATION · SYNOVIA · GIRDLE[2] · ARTHRITIS · ARTICULATE[1] · ARTICULAR ↑ SKELETON

CK125 articulation (*n.*) The disposition relating two structures or objects so that they have the ability to move relative to each other, *e.g.* when the forearm moves in relation to the upper arm, the two parts of the arms exhibit articulation at the elbow □ *articulation occurs at the elbow; articulation takes place at the elbow; movable joints exhibit articulation* —ARTICULATE (*v.*) ARTICULATED (*adj.*) ↓ BALL-AND-SOCKET JOINT · HINGE JOINT ↑ JOINT[2] → SUTURE

CK126 ball-and-socket joint (*n.*) A joint in which the rounded, ball-shaped end of one bone fits into a cup-like hollow in another bone; it allows movement in three dimensions, *i.e.* in planes at right angles and all positions between the planes. ↑ ARTICULATION

CK127 hinge joint (*n.*) A joint in which the convex, cylindrical end of one bone fits on the concave, cylindrical or flat end of another bone; the joint allows movement in one plane only. ↑ ARTICULATION

CK128 synovia (*n.*) A viscous liquid containing mucoprotein; it lubricates the smooth cartilage surfaces at the ends of bones forming a joint. —***synovial*** (*adj.*) ↓ SYNOVIAL FLUID · SYNOVIAL CAPSULE · SYNOVIAL MEMBRANE · SYNOVIAL SAC ↑ JOINT[2]

CK129 synovial fluid (*n.*) Alternative term for SYNOVIA.

CK130 synovial capsule (*n.*) A capsule enclosing a freely movable joint. ↑ SYNOVIA

CK131 synovial membrane (*n.*) The inner layer of a synovial capsule consisting of connective tissue secreting synovia; it encloses a synovial sac. ↑ SYNOVIA

CK132 synovial sac (*n.*) See SYNOVIAL MEMBRANE.

CK133 girdle[2] (*n.*) (In vertebrates) a bony or cartilaginous supporting structure for the appendicular skeleton; it consists of one dorsal and two ventral elements. ↑ JOINT[2]

CK134 arthritis (*n.*) Inflammation of a joint. ↓ SCIATICA ↑ JOINT[2]

CK135 sciatica (*n.*) Inflammation of the sciatic nerve, causing pain. ↑ ARTHRITIS

CK136 articulate[1] (*v.i.*) (Of a part of the body or a structure) to move in relation to another part of the body or structure to which it is joined □ *the thigh* articulates with *the pelvic girdle* —ARTICULAR, ARTICULATE (*adj.*) ↑ JOINT[2]

CK137 articular (*adj.*) Of, to do with, or situated at a joint, *e.g.* an articular suface on a bone is part of the joint. ↓ ARTICULATE[2] · ARTICULATED · ARTHRITIC ↑ JOINT[2]

CK138 articulate[2] (*adj.*) Possessing joints. ↑ ARTICULAR

CK139 articulated (*adj.*) Capable of relative movement between parts of the whole. ↑ ARTICULAR

CK140 arthritic (*adj.*) Of, to do with, or situated at, a joint, *e.g.* a synovial capsule is an arthritic structure. ↑ SYNOVIAL CAPSULE · ARTICULAR

CK141 pectoral girdle (*n.*) The girdle for supporting the front appendages; at no point is it fused to the vertebral column. The dorsal unit is the scapula, the ventral units are the coracoid and clavicle. In fishes, the girdle consists of an incomplete hoop of cartilage or bone situated transversely to the vertebral column, just behind the branchial region. On the ventral side it is complete, on the dorsal side it tapers to points which lie on either side of the vertebral column, and are attached by ligaments to it. At the midpoint of the hoop on either side, are the glenoid facets. Ventral to the facets is the coracoid portion; dorsal to the facets are the two wing-like scapular portions. In amphibians, it consists of two U-shaped half rings, joined at the mid-ventral line in a symphysis, formed from the epicoracoids. The coracoid extends from the epicoracoid to the glenoid cavity. Anterior to the coracoid is the clavicle. The scapula joins the coracoid and clavicle to form the glenoid cavity, and continues dorsally to form the half ring with the suprascapula. The two suprascapulae do not meet; they are joined to the vertebral column by ligaments. The sternum is fused with the girdle and consists of four sternebrae. In reptiles, birds, and most mammals, the clavicle is much reduced; the coracoid, except for mammals, is the ventral support. In mammals, the coracoid is reduced to a protuberance on the scapula. ↓ CORACOID · SCAPULA · STERNEBRA · PECTORAL ↑ SKELETON

CK142 coracoid (*n.*) A ventral bone of the pectoral girdle, situated between the scapula and the sternum; it meets the scapula and the clavicle at the glenoid process. In mammals it is reduced to a small rounded process on the distal side of the scapula; in other vertebrates it is the main ventral bone. ↓ CLAVICLE · COLLAR-BONE · EPICORACOID · SHOULDER GIRDLE ↑ PECTORAL GIRDLE

CK143 clavicle (*n.*) A ventral bone of the pectoral girdle between the scapula and sternum; it meets the scapula at the glenoid cavity. In all vertebrates it is a long, thin, bone; in many mammals it is reduced to a thin rod suspended in a fibrous band stretching from the sternum to the scapula. In birds the two clavicles are fused at their median ends. In man it is the collar-bone. ↑ CORACOID

CK144 collar-bone (*n.*) (In man) a long, curved, thin bone forming the superior, ventral part of the pectoral girdle; it articulates with the scapula at the lateral end and with the sternum at the medial end. ↑ CORACOID

CK145 epicoracoid (*n.*) (In amphibians and reptiles) a small strip of cartilage on the coracoid; the left and right epicoracoids fuse to form a symphysis, and to form the attachment of the sternum to the pectoral girdle. The epicoracoid is anterior to the

sternum and posterior to the omosternum. ↓ STERNUM[1] ↑ CORACOID

CK146 shoulder girdle (*n.*) Alternative term for PECTORAL GIRDLE (↑).

CK147 scapula (*n., pl.* **scapulae**) The dorsal bone of the pectoral girdle; it is usually flat and is either elongated, L-shaped or triangular (in man it is triangular). It has a spine running from one end to the other and a glenoid cavity at the lateral end of the bone. In mammals, the coracoid process projects above the glenoid cavity; in other vertebrates, the coracoid lies between the scapula and the sternum. In amniotes, the scapula is bound to the rib-cage by strong muscles; in amphibia, it is joined to the vertebral column by ligaments. —***scapular*** (*adj.*) ↓ CORACOID PROCESS · GLENOID CAVITY · ACROMION · METACROMION · SUPRASCAPULA · SHOULDER-BLADE ↑ PECTORAL GIRDLE

CK148 coracoid process (*n.*) (In most mammals) a pointed, hooked process on the lateral, anterior corner of the scapula projecting above the glenoid cavity; it is the vestige of the coracoid. ↑ SCAPULA

CK149 glenoid cavity (*n.*) (In tetrapods) a cup-shaped cavity in the scapula, or formed by the scapula, coracoid and clavicle (when these are present); the head of the humerus fits into and articulates with the glenoid cavity. ↑ SCAPULA

CK150 acromion (*n.*) A ventral process of the spine on the scapula, connected to the clavicle by ligaments. ↑ SCAPULA

CK151 metacromion (*n.*) A small, posterior branch of the acromion. ↑ SCAPULA

CK152 suprascapula (*n.*) A cartilaginous extension of the scapula, varying from a thin, broad, square-shaped plate in amphibians, to a narrow band of cartilage in mammals. ↑ SCAPULA

CK153 shoulder-blade (*n.*) (In man) an alternative term for the SCAPULA.

CK154 sternebra (*n., pl.* **sternebrae**) One of the number of elements into which the sternum is divided in vertebrates; the divisions vary with the species. Sternebrae include: xiphisternum, sternum, omosternum, episternum. ↓ STERNUM[1] · OMOSTERNUM · EPISTERNUM · INTERCLAVICLE · XIPHISTERNUM · KEEL[1] · CARINA ↑ PECTORAL GIRDLE

CK155 sternum[1] (*n.*) The bone in the midline of the ventral side of the thoracic cavity; at its anterior end it is joined to the pectoral girdle. In amniotes, the ventral ends of the true ribs are attached to it. In amphibians, it is not joined to the ribs; it is continued posteriorly as the xiphisternum, and anteriorly as the epicoracoid, omosternum, and episternum, the epicoracoid being the part joined to the pectoral girdle. —***sternal*** (*adj.*) ↑ STERNEBRA

CK156 omosternum (*n.*) (In amphibians) an anterior element of the sternum; (in some mammals) a cartilage, or bone, between the sternum and clavicle. ↑ STERNEBRA

CK157 episternum (*n.*) **1** (In amphibians) an element of the sternum anterior to the omosternum. **2** An alternative term for INTERCLAVICLE (↓). ↑ STERNEBRA

CK158 interclavicle (*n.*) A small bone which is median and ventral, between the right and left clavicle. ↑ STERNEBRA

CK159 xiphisternum (*n.*) A pointed disc or flap of cartilage at the posterior end of the sternum. ↑ STERNEBRA

CK160 keel[1] (*n.*) A thin, plate-like projection of bone from the sternum of a bird or bat; it provides a firm place of attachment for the large wing muscles. ↑ STERNEBRA → WING

CK161 carina (*n.*) **1** An alternative term for KEEL[1](↑). **2** Any structure resembling the keel of a bird. ↑ STERNEBRA

CK162 pectoral (*adj.*) Of or to do with the chest region, *i.e.* the ventral surface of the thoracic cavity. ↓ CERVICAL · SUBCLAVIAN ↑ PECTORAL GIRDLE → THORAX[1]

CK163 cervical (*adj.*) Of or to do with the neck, or the neck region. ↑ PECTORAL → CERVIX[1]

CK164 subclavian (*adj.*) Underneath the clavicle. ↑ PECTORAL

CK165 pelvic girdle (*n.*) (In vertebrates) the girdle for supporting the hind appendages. The dorsal unit is the ilium, and the two ventral units are the anterior pubis and the posterior ischium. In fishes, the girdle consists of a straight bar of cartilage (cartilaginous fishes) or a curved bone (bony fishes) forming a half loop, situated transversely to the vertebral column, a little anterior to the cloaca. At the middle of the structure is an articulating facet (acetabular facet) with the pelvic fin. The part dorsal to the joint is the ilium, the ventral part is the ischio-pubis. In tetrapods, a more rigid structure gives support to the hind limbs. In amphibians, the girdle is a V-shaped structure, with two long, slender ilia, which articulate with the two transverse processes of the sacrum. Each ilium joins with two units, a posterior ischium and an anterior, ventral, pubis. At the junction of the three structures lies the acetabulum. In amniotes, the ilium is fused to two or more sacral vertebrae; the right and left portions of the girdle fuse at the pubic symphysis, and the remaining bones fuse to form a solid bony cavity. ↓ ILIUM · PUBIS · INNOMINATE BONE · PELVIMETRY · COXAL ↑ SKELETON → TETRAPOD

CK166 ilium (*n., pl.* **ilia**) The dorsal element of the pelvic girdle; in tetrapods it is fused to one or more sacral vertebrae to give stability for the attachment of hind limbs. In fishes, it is a simple bar of bone or cartilage attached to the vertebral column by ligaments. The ilium varies in shape from a simple bar in fishes to a bowl-shaped bone in man. ↓ ISCHIUM · ACETABULUM[1] ↑ PELVIC GIRDLE

CK167 ischium (*n.*) (In tetrapods) a ventral, posterior bone in the pelvic girdle; it joins with the ilium and the pubis at the acetabulum. In primates, it bears the weight when the animal sits. —***ischiadic*** (*adj.*) ↓ SCIATIC ↑ ILIUM

CK168 acetabulum[1] (*n.,pl.* **acetabula**) (In tetrapods) the cup-like hollow (the **socket**), into which the ball-ended head of the femur fits to form the hip joint. It is situated at the join of the ilium, the ischium, and the pubis. There is an acetabulum on each side of the pelvic girdle. —***acetabular*** (*adj.*) ↑ ILIUM

CK169 pubis (*n.,pl.* **pubes**) (In tetrapods) a ventral, anterior bone in the pelvic girdle; the right and left pubes are sometimes fused. —PUBIC (*adj.*) ↓ ISCHIOPUBIS · PUBIC SYMPHYSIS · PUBIC BONE · PUBES · EPIPUBIC BONE · OBTURATOR FORAMEN ↑ PELVIC GIRDLE

CK170 ischiopubis (*n.*) The ischium of fishes, the pubis not being included in the acetabulum; it is the ventral part of the bar of bone, or cartilage, in the hip girdle. ↑ PUBIS

CK171 pubic symphysis (*n.*) (In many reptiles, and most mammals, but not in birds, except the ostrich) a fusion of the two pubic bones; it lies mid-ventrally in the pelvic girdle. ↑ PUBIS

CK172 pubic bone (*n.*) Alternative term for the PUBIS (↑).

CK173 pubes (*n.*) The region of the body over the pubis; in human beings it is covered in hair from puberty. ↑ PUBIS

CK174 epipubic bone (*n.*) (In marsupials) a slender bone on the anterior end of the pubis; the two epipubic bones support the pouch, or marsupium. ↑ PUBIS → MARSUPIUM

CK175 obturator foramen (*n.*) An oval or triangular-shaped hole surrounded by two bones, the ischium and the pubis. ↑ PUBIS

CK176 innominate bone (*n.*) In adult amniotes, where the bones of one half of the pelvic girdle are fused together (*i.e.* the ilium, the ischium and pubis), the single bony structure is called the innominate bone. ↓ PELVIS[1] · PELVIC CAVITY · OS INNOMINATUM ↑ PELVIC GIRDLE

CK177 pelvis[1] (*n.*) (In primates) the bony cavity formed by the pelvic girdle, sacrum, and coccyx. —PELVIC (*adj.*) ↑ INNOMINATE BONE → COCCYX · SACRUM

CK178 pelvic cavity (*n.*) The lower part of the abdomen surrounded by the pelvis. ↑ INNOMINATE BONE

CK179 os innominatum (*n.*) An alternative term for the INNOMINATE BONE (↑).

CK180 pelvimetry (*n.*) The measurement, in connection with giving birth, of the dimensions of the human, female pelvis. ↑ PELVIC GIRDLE

CK181 coxal (*adj.*) Of or to do with the hip. ↓ SCIATIC · PUBIC · PELVIC ↑ PELVIC GIRDLE

CK182 sciatic (*adj.*) Of or to do with the hip region, *e.g.* the sciatic nerve and the sciatic artery are structures in the hip region. ↑ COXAL

CK183 pubic (*adj.*) Of or to do with the pubes, *e.g.* ***a*** pubic symphysis is the fusion of the right and left pubic bones; ***b*** the pubic hairs are those covering the pubes. ↑ COXAL

CK184 pelvic (*adj.*) Of, to do with or situated near the pelvis, or the region associated with articulation of the hind limbs, *e.g.* ***a*** the pelvic fin is a fin attached to the pelvic girdle; ***b*** the pelvic plexus is a nervous plexus situated in the pelvis. ↑ COXAL

CK185 tagma (*n.,pl.* **tagmata**) One of the three main divisions of the body of an arthropod, *i.e.* the head, thorax and abdomen; each tagma consists of segments. ↓ THORAX[2] · OCCIPUT[2] · ACETABULUM[2] · ARTHRODIA · PEDIPALP · CARAPACE · LOPHOPHORE · ANNULAR[2] · PROGLOTTIS · OSCULUM ↑ SKELETON

CK186 thorax[2] (*n.*) (In insects) the tagma of three segments between the head and the abdomen. It bears three pairs of legs, and, if present, wings. —***thoracic*** (*adj.*) ↓ PROTHORAX · MESOTHORAX · METATHORAX · ABDOMEN[2] · CEPHALOTHORAX · PROSOMA · OPISTHOSOMA ↑ TAGMA

CK187 prothorax (*n.*) (In insects) the anterior segment of the thorax; it bears a pair of legs, but no wings. ↑ THORAX[2]

CK188 mesothorax (*n.*) The middle section of the thorax posterior to the prothorax; it bears a pair of legs and, if present, a pair of wings. ↑ THORAX[2]

CK189 metathorax (*n.*) The posterior segment of the thorax, posterior to the mesothorax; it bears a pair of legs, and, if present, a pair of wings. ↑ THORAX[2]

CK190 abdomen[2] (*n.*) (In some arthropods) the posterior tagma, consisting of similar segments, *e.g.* the abdomen of an insect. It bears no true legs or wings. —***abdominal*** (*adj.*) ↑ THORAX[2]

CK191 cephalothorax (*n.*) (In arachnids and crustaceans) the part of the body formed from the head and the thorax fused in one structure. ↑ THORAX[2]

CK192 prosoma (*n.*) The anterior body region, *e.g.* the cephalothorax of an arthropod. ↑ THORAX[2]

CK193 opisthosoma (*n.*) The posterior body region, as in arachnids. ↑ THORAX[2]

CK194 occiput[2] (*n.*) (In insects) a chitinous plate covering the dorsal area of the head. ↓ TERGUM · TERGITE · STERNUM[2] · STERNITE ↑ TAGMA

CK195 tergum (*n.,pl.* **terga**) **1** The dorsal side of a segment of an arthropod. **2** An alternative term for TERGITE(↓). —***tergal*** (*adj.*) ↑ OCCIPUT[2]

CK196 tergite (*n.*) The hard plate of chitin covering the dorsal side of a segment of an arthropod; part of the exoskeleton. ↑ OCCIPUT[2]

CK197 sternum[2] (*n.*) **1** The ventral side of a segment of an arthropod. **2** An alternative term for STERNITE(↓). ↑ OCCIPUT[2]

CK198 sternite (*n.*) The hard plate of chitin covering the ventral side of a segment of an arthropod; part of the exoskeleton. ↑ OCCIPUT[2]

CK199 acetabulum[2] (*n.,pl* **acetabula**) (In insects and arachnids) a cavity in the thorax into which the coxa fits. —***acetabular*** (*adj.*) ↓ COXA · TROCHANTER[2] · FEMUR[2] · TIBIA[2] · TARSUS[2] · CHELICERA · CHELA · PINCER ↑ TAGMA

CK200 coxa (*n.*) **1** The most proximal part

of the segmented leg of an insect or arachnid; it is a stout basal element of the leg. The coxa is called the first joint of a segmented leg. **2** The hip in tetrapods. —COXAL (*adj.*) ↑ ACETABULUM[2]

CK201 trochanter[2] (*n.*) (In insects and arachnids) a short, articulating segment of the leg distal to the coxa; the second joint of a segmented leg. —***trochanteric*** (*adj.*) ↑ ACETABULUM[2] → ARTICULATE[1]

CK202 femur[2] (*n.*) A long, articulating segment distal to the trochanter; the third joint of a segmented leg. —***femoral*** (*adj.*) ↑ ACETABULUM[2]

CK203 tibia[2] (*n.*) A long, slender, articulating segment distal to the femur; the fourth joint of a segmented leg. —***tibial*** (*adj.*) ↑ ACETABULUM[2]

CK204 tarsus[2] (*n.*) A long segment distal to the tibia; it consists of five pieces, the terminal piece being armed with a claw. —***tarsal*** (*adj.*) ↑ ACETABULUM[2]

CK205 chelicera (*n.,pl.* **chelicerae**) An appendage, with claws, of an arachnid. ↑ ACETABULUM[2]

CK206 chela (*n.pl.* **chelae**) (In some crustaceans and arachnids) a pincer-like claw borne on certain appendages. The penultimate segment forms an outgrowth which acts together with the end segment, in the same fashion as the thumb and finger, to pick up an object. —***chelate*** (*adj.*) ↑ ACETABULUM[2]

CK207 pincer (*n.*) Alternative term for CHELA.

CK208 arthrodia (*n.*) A joint capable of a sliding motion only, not capable of turning, *e.g.* a joint in the leg of an insect which allows a limited flexion between the two leg parts. —***arthrodial*** (*adj.*) ↑ TAGMA

CK209 pedipalp (*n.*) (In arachnids) one of the second pair of appendages. In king-crabs they are used for locomotion; in scorpions they possess claws for gripping; in male spiders they are used for carrying a spermatophore for fertilization of females; in other arachnids they may be sensory. ↑ TAGMA → SPERMATOPHORE

CK210 carapace (*n.*) A shield of bone, horn or chitin covering all or part of the dorsal side of certain animals, *e.g.* crabs, turtles and tortoises. ↓ MANTLE[2] · WHORL[2] · CALCIFY · CALCIFEROUS ↑ TAGMA

CK211 mantle[2] (*n.*) (In molluscs) a fold of skin covering all or most of the body, it forms a cavity between the mantle and the body. The outer surface of the mantle secretes the shell. ↓ MANTLE CAVITY · MANTLE LOBES ↑ CARAPACE

CK212 mantle cavity (*n.*) The cavity between the mantle and the body of a mollusc; it contains gills which are modified, in some molluscs, as specialized feeding organs. ↑ MANTLE[2]

CK213 mantle lobes (*n.pl.*) (In certain molluscs and crustaceans, such as bivalves) the dorsal and ventral flaps or lobes of the mantle. ↑ MANTLE[2]

CK214 whorl[2] (*n.*) **1** One complete circle of the spiral of a shell. **2** One complete circle of flower parts, such as petals, arising from one level of a stem. ↑ CARAPACE

CK215 calcify (*v.*) (Of tissue) to make or become hard by the deposition of calcium salts, as in bone or enamel. —CALCIFEROUS, CALCIFIC (*adj.*) ↑ CARAPACE

CK216 calciferous (*adj.*) Describes a tissue containing calcium salts, *e.g.* bone is a calciferous tissue because it contains calcium carbonate and calcium phosphate. ↓ CALCIFIC ↑ CARAPACE

CK217 calcific (*adj.*) Describes a structure using calcium salts to form a calciferous tissue, *e.g.* the part of the oviduct in reptiles and birds which forms egg shells. ↑ CALCIFEROUS

CK218 lophophore (*n.*) (In Brachiopoda and Polyzoa) an outgrowth round the mouth, supporting tentacles or arms. ↑ TAGMA

CK219 annular[2] (*adj.*) Ring-like in structure. ↓ ANNULATE

CK220 annulate (*adj.*) Consisting of a number of ring-like structures or segments. To contrast **annular** and **annulate**: A segment of an earthworm is annular; the earthworm is annulate as it is composed of many annular structures. ↑ ANNULAR[2]

CK221 proglottis (*n.,pl.* **proglottides**) A segment of a tapeworm; the entire worm consists of many proglottides in the form of a ribbon. Each proglottis contains both male and female sex organs; when mature, the eggs are fertilized, the proglottis degenerates into a mass of eggs, and is passed out with faeces. ↓ STROBILA ↑ TAGMA

CK222 strobila (*n.,pl.* **strobilae**) The chain of proglottides which form the body of a tapeworm. ↑ PROGLOTTIS

CK223 osculum (*n.*) (Of sponges) an opening through which water leaves the spongocoel. ↓ SPICULE · OSTIAL ↑ TAGMA → SPONGOCOEL

CK224 spicule (*n.*) (In invertebrates) a minute, needle-like, hard structure, usually calcareous or siliceous, although in sponges it may be formed from spongin; its function is to provide support for the soft body of the animal. —***spicular,*** SPICULATE, ***spiculiform*** (*adj.*) ↑ OSCULUM

CK225 ostial (*adj.*) Of or to do with ostia or an ostium □ *ostial currents of water are drawn into a sponge* ↓ OSTIATE · SPICULATE ↑ OSCULUM

CK226 ostiate (*adj.*) Possessing ostia □ *sponges are ostiate* ↑ OSTIAL → OSTIUM

CK227 spiculate (*adj.*) Describes a structure composed of spicules. ↑ OSTIAL

Histology

CL001 tissue (*n.*) A group of cells, forming a region or layer in an organism, which perform the same function. The cells are associated in large numbers; in plants they are mainly bound together by cell-walls; in animals they are mainly bound together by intercellular material. Blood and lymph are the only animal tissues which are liquid; no plant tissues are liquid. —TISSUE (*adj.*) ↓ PLASMODIUM · DIFFERENTIATION[2] · TISSUE CULTURE · HISTOLOGY → EPITHELIAL TISSUE · CONNECTIVE TISSUE · MUSCULAR TISSUE · NERVOUS TISSUE · BLOOD · CELLULOSE

CL002 plasmodium (*n.*) An amoeboid mass of protoplasm, containing many nuclei and bounded by a plasma membrane, *e.g.* plasmodium, forming the vegetative plant body of the slime fungi. ↓ SYNCYTIUM · COENOCYTE[1] · PLASMODESMATA · PARENCHYMA[2] ↑ †ISSUE

CL003 synctium (*n.,pl.* **synctia**) A mass of nucleated protoplasm which is not differentiated into cells; it is held together by a plasma membrane, *e.g.* striped muscle fibre. A synctium is a tissue □ *the multinucleate synctia of striped muscle fibre found in vertebrates; striped muscle is a synctium* —***synctial*** (*adj.*) ↑ PLASMODIUM

CL004 coenocyte[1] (*n.*) mass of protoplasm with many nuclei, formed from an original uninucleate cell by division of the nucleus, but without division of the cytoplasm into individual cells; it is bounded by a cell wall. It occurs in many fungi where coenocytes are found in the hyphae and also occurs in some green algae. The term is used for plants, while **synctium** is correspondingly used for animals □ *a fungal hypha is often a coenocyte; the whole of the somatic mycelium of Pythium is a coenocyte* —***coenocytic*** (*adj.*) ↑ PLASMODIUM · SYNCTIUM

CL005 plasmodesmata (*n.pl., sing.* **plasmodesma**) (In plant cells) delicate threads of protoplasm which pass through the cell wall of living cells to connect with the cytoplasm of adjacent cells. ↑ PLASMODIUM

CL006 parenchyma[2] (*n.*) **1** (In animals) the specific cells of an organ, especially a gland, rather than the connective tissue, blood-vessels and other framework. **2** (In Platyhelminthes) loose, sponge-like tissue consisting of vacuolated cells with intercellular spaces filled with liquid or jelly-like materials; it forms the greater part of the body. —PARENCHYMAL, PARENCHYMATOUS (*adj.*) ↑ PLASMODIUM

CL007 differentiation[2] (*n.*) **1** The modification that takes place in cells resulting in a change in the structure and function of the cell, and hence, when many cells are modified, a modification in the tissue composed of the cells. *E.g.* ***a*** Meristematic plant cells show no differentiation in function, but when they develop into permanent tissues, they undergo differentiation and become changed in structure (*e.g.* elongated), and allied in function (*e.g.* vascular, and epidermal), so that the tissue composed of the cells is organised for the division of labour in the mature plant. ***b*** The cells in embryonic animal tissue differentiate to form the permanent tissues of the young animal □ *tissues undergo differentiation* —***differentiated*** (*adj.*) ***differentiate*** (*v.*) ↓ ELABORATION[1] · ORGANIZATION · DIVERSIFICATION ↑ TISSUE

CL008 elaboration[1] (*n.*) The changes that take place in a tissue when it develops from a crude, or simple, state, to a more complex or an adult stage, *e.g.* the simple sieve-tubes of protophloem become elaborated into the sieve-tubes, companion cells, and supporting ground tissue of the phloem in the mature plant. ↑ DIFFERENTIATION[2]

CL009 organization (*n.*) The grouping together of specialized cells performing the same function; this starts in embryonic growth. ↑ DIFFERENTIATION[2]

CL010 diversification (*n.*) The variety of structure and function found in the cells of a metazoan; the variety has been produced by specialization. —***diverse*** (*adj.*) ↑ DIFFERENTIATION[2] → SPECIALIZATION[1]

CL011 tissue culture (*n.*) Tissue fragments, together with a liquid of the correct physiological properties, are placed in a glass vessel and kept under suitable conditions, which include the supplying of oxygen and food substances. Bacteria, fungi, and other foreign organisms are carefully excluded. In this way the tissue is maintained alive for observation and experiment. This technique is known as tissue culture. ↑ TISSUE → TISSUE FLUID · TISSUE RESPIRATION

CL012 histology (*n.*) The study of the structure and function of tissues. —***histological*** (*adj.*) ↑ TISSUE → CYTOLOGY · ORGANOLOGY · ANATOMY · MORPHOLOGY · PHYSIOLOGY

Epithelial Tissue

CM001 epithelial tissue (*n.*) Tissue consisting of a sheet of cells, held together by a minimal amount of cement-like material between the cells. It covers exposed surface and lines the cavities and tubes of animals. Beneath most epithelial tissue is a thin sheet

of connective tissue, the basement membrane. Besides its protective function, epithelial tissue frequently has a secretory function, in which case it is sometimes known as glandular tissue. ↓ EPITHELIUM · COLUMNAR EPITHELIUM · EPITHELIAL · SQUAMOUS[1] · GLANDULAR EPITHELIUM · GLAND → TISSUE

CM002 epithelium (*n.*, *pl.* **epithelia**) A sheet of epithelial tissue; epithelium is derived from ectoderm and endoderm. —EPITHELIAL (*adj.*) ↑↓ SIMPLE EPITHELIUM · STRATIFIED EPITHELIUM · BASEMENT MEMBRANE · ENDOTHELIUM · MESOTHELIUM · SENSORY EPITHELIUM ↑ EPITHELIAL TISSUE → ECTODERM · ENDODERM

CM003 simple epithelium (*n.*) A layer of epithelium, one cell thick. ↑ EPITHELIUM

CM004 stratified epithelium (*n.*) Stratified epithelium consists of several layers of cells lying on a basement membrane. The cells near the surface are smaller and flatter than those near the base. The bottom cells are continually dividing, giving rise to new layers. The upper layers become flat and scaly and are rubbed off. Stratified epithelium is found as an outer covering in skin which is continually being worn down and replaced. ↑ EPITHELIUM → MALPIGHIAN LAYER · CORNIFIED LAYER

CM005 basement membrane (*n.*) A very thin sheet of connective tissue below the epithelia of most animals. It usually contains polysaccharide and very fine fibres of reticulin and collagen. ↑ EPITHELIUM → RETICULIN

CM006 endothelium (*n.*,*pl.* **endothelia**) (In vertebrates) a single layer of squamous cells lining the heart, blood vessels and lymphatic vessels. The cells are tessellated, *i.e.* have wavy boundaries which interdigitate, or fit together. Endothelium is morphologically similar to epithelium, but is derived from mesoderm. —***endothelial*** (*adj.*) ↑ EPITHELIUM → MESODERM

CM007 mesothelium (*n.*,*pl.* **mesothelia**) (In vertebrates) a sheet of tissue lining the cavities of the coelom and synovial sacs. It consists of a single layer of squamous cells and is derived from mesoderm. —***mesothelial*** (*adj.*) ↑ EPITHELIUM → PERICARDIUM · PERITONEUM · PLEURA

CM008 sensory epithelium (*n.*) An epithelium containing groups of cells which are sensitive to certain stimuli. Sensory epithelia form olfactory, auditory and optic organs. ↑ EPITHELIUM → CHEMORECEPTOR · CORTI'S ORGAN · RETINA

CM009 columnar epithelium (*n.*) Epithelium containing nucleated cells which are tall and column-shaped; they form a single layer of cells in simple columnar epithelium, and several layers in stratified epithelium. Columnar epithelium is commonly found in the gut of animals. ↓ CILIATED EPITHELIUM · CUBICAL EPITHELIUM · SQUAMOUS EPITHELIUM · PAVEMENT EPITHELIUM ↑ EPITHELIAL TISSUE

CM010 ciliated epithelium (*n.*) Columnar epithelium bearing cilia on its outer surface; this type of epithelium is found in the trachea and bronchi of tetrapods. ↑ COLUMNAR EPITHELIUM → CILIA

CM011 cubical epithelium (*n.*) Epithelium containing nucleated cells which are as wide as they are tall; they either form a single layer or are stratified. This type of epithelium is found in many glands. ↑ COLUMNAR EPITHELIUM

CM012 squamous epithelium (*n.*) Epithelium containing nucleated cells which are thin and flat; they either form a single layer or are stratified. Simple squamous epithelium is found in the lining of kidney tubules. ↑ COLUMNAR EPITHELIUM

CM013 pavement epithelium (*n.*) Alternative term for SQUAMOUS EPITHELIUM, especially when the epithelium is on an outside surface.

CM014 epithelial (*adj.*) Of or to do with epithelia. ↓ EPITHELIOID ↑ EPITHELIAL TISSUE

CM015 epithelioid (*adj.*) Resembling epithelia. ↑ EPITHELIAL

CM016 squamous[1] (*adj.*) **1** Consisting of scales. **2** Describes flat scale-like cells. ↓ STRATIFIED[1] ↑ EPITHELIAL TISSUE

CM017 stratified[1] (*adj.*) **1** Arranged in layers, *e.g.* as in compound epithelium where the cells are arranged in layers one on top of the other. **2** Describes a vertical grouping within a community, interconnected from top to bottom. ↑ SQUAMOUS[1]

CM018 glandular epithelium (*n.*) Epithelium with the specialized function of secreting metabolic substances. The secretory cells may be interspersed among ordinary epithelial cells, forming a secreting membrane or they may be grouped together to form a gland. ↓ GLANDULAR CELLS · MUCUS · MUCOUS ↑ EPITHELIAL TISSUE → SECRETE · GLAND

CM019 glandular cells (*n.pl.*) Secretory cells occurring in epithelia; they are generally bigger than the supporting epithelial cells, possess large nuclei and their cytoplasm is conspicuously granulated. Their function is to produce liquid secretions for use in metabolism in animals (as in glands), and for external discharge in plants. ↓ GLAND CELL · GOBLET CELL · GLAND ↑ GLANDULAR EPITHELIUM

CM020 gland cell (*n.*) Alternative term for GLANDULAR CELL (↑).

CM021 goblet cell (*n.*) A pear-shaped glandular cell interspersed among columnar epithelial cells. The top of the cell, at the surface of the epithelium, is swollen with mucin secreted by the cell. ↑ GLANDULAR CELLS

CM022 mucus (*n.*) (In animals) a thin, slimy, viscous liquid secreted by epithelial cells in tissues or glands; secreted by animals, it protects and lubricates the surface of structures, *e.g.* the internal surfaces of the greater part of the alimentary canal are lubricated with mucus. —MUCOSA (*n.*) MUCOUS, MUCOID (*adj.*) ↓ MUCOSA · MUCIN · MUCOPROTEIN · GLYCOPROTEIN ·

MUCOPOLYSACCHARIDE · MUCOUS MEMBRANE ↑ GLANDULAR EPITHELIUM → MUCILAGE

CM023 mucosa (*n.*) (In vertebrates) a mucous membrane consisting of moist epithelium and the connective tissue immediately beneath it. It usually consists of simple epithelium, but is stratified near openings to the exterior. It is often ciliated, and often contains goblet cells. Mucosa is found in the lining of the gut and in the urino-genital ducts. ↑ MUCUS

CM024 mucin (*n.*) A mucoprotein which forms mucus in solution. ↑ MUCUS

CM025 mucoprotein (*n.*) A complex compound of protein and polysaccharide; its predominant chemical reaction is that of a protein. ↑ MUCUS

CM026 glycoprotein (*n.*) Alternative term for MUCOPROTEIN.

CM027 mucopolysaccharide (*n.*) A complex compound of polysaccharide and protein; its predominant chemical reaction is that of a polysaccharide. It consists of linked disaccharide units, each of which contains an amino sugar, *e.g.* glucosamine. ↑ MUCUS

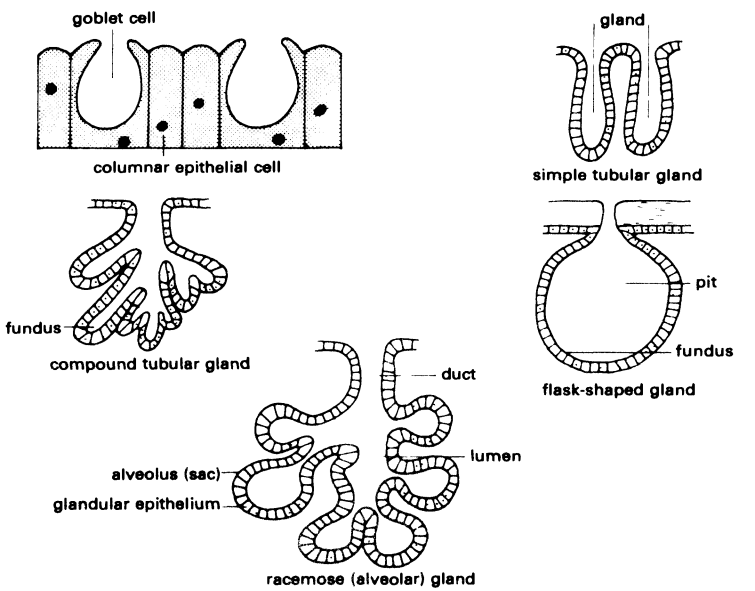
CM028 mucous membrane (*n.*) Alternative term for MUCOSA (↑).

CM029 mucous (*adj.*) **1** (Of a cell) secreting mucus, *e.g.* a mucous membrane. **2** (Of tissue) covered with mucus. ↓ MUCOID ↑ GLANDULAR EPITHELIUM → MUCILAGINOUS

CM030 mucoid (*adj.*) Like mucus in appearance and properties. ↑ MUCOUS

CM031 gland (*n.*) **1** (In animals) an organ manufacturing substances for secretion. It may be large, *e.g.* the liver, or it may be small, *e.g.* a sweat gland. It functions by taking chemical substances and water from the blood, and then by synthesizing from these materials the compounds for secretion. Glands are either exocrine or endocrine, and their methods of secretion are either holocrine, merocrine or apocrine. They are also described by their shape *e.g.* tubular, racemose, flask-shaped. **2** (In plants) an organ, always small, and generally superficial and discharging a secretion externally, *e.g.* ***a*** glandular hair such as the stinging hairs of a nettle; **b** a nectary; **c** a hydathode. Some glands are embedded in tissue; they are either single cells, or layers of cells surrounding a cavity; they discharge a secretion into the cavity, *e.g.* resin in pine trees. —GLANDULAR (*adj.*) ↓ TUBULAR GLAND · FUNDUS · SALIVARY GLANDS · PEPTIC CELLS · ADENITIS · GLANDULAR · EXOCRINE ↑ GLANDULAR EPITHELIUM · GLANDULAR CELLS · EPITHELIAL TISSUE → NECTARY · HYDATHODE

CM032 tubular gland (*n.*) (In animals) the simplest form of a group of glandular cells. It is either **simple**, consisting of a tube lined with glandular epithelium, or **compound**, consisting of branching tubes. Simple tubular glands are found in the small intestine of mammals, situated at the base of villi. Compound tubular glands are found in the stomach wall of mammals. A sweat gland is a modified tubular gland, with the tube coiled in a knot. ↓ FLASK-SHAPED GLAND · RACEMOSE GLAND · ALVEOLAR GLAND ↑ GLAND → GOBLET CELL



TYPES OF GLAND

CM033 flask-shaped gland (*n.*) (In amphibians) a round cell with a short, narrow neck leading to the pit of the gland; the pit is lined with squamous glandular epithelial cells secreting mucus. The mucus is stored in the cell until required, when it is poured through the narrow neck. ↑ TUBULAR GLAND

CM034 racemose gland (*n.*) A modification of a tubular gland. The ends of the tubes are enlarged into sacs, or **acini**, with each acinus lined with glandular epithelium consisting of bulbous chambers, called **alveoli.** Racemose glands are found in the duodenum, salivary glands and the pancreas of mammals. ↓ ACINUS ↑ TUBULAR GLAND → RACEMOSE

CM035 alveolar gland (*n.*) Alternative term for RACEMOSE GLAND.

CM036 fundus (*n.*) **1** The bottom of a tube or of a compound tubular gland, or of a flask-shaped gland. The fundus is lined with glandular cells but the remaining epithelial cells are non-glandular and form the duct (or the neck) of the gland. **2** The base of an organ, *e.g.* the stomach. ↓ ACINUS ↑ GLAND

CM037 acinus (*n., pl.* **acini**) One of the cluster of sacs in a cluster of bulbous alveoli at one of the ends of a racemose gland; it is lined with glandular cells, the remaining epithelial cells being non-glandular. ↑ FUNDUS

CM038 salivary glands (*n.pl.*) Glands which secrete saliva into the buccal cavity or the oesophagus. ↑ GLAND → SALIVA

CM039 peptic cells (*n.pl.*) Glandular cells secreting pepsinogen; they are found in the tubular glands in the stomach wall of mammals. ↓ OXYNTIC CELLS ↑ GLAND

CM040 oxyntic cells (*n.pl.*) Glandular cells secreting hydrochloric acid; they are found in the tubular glands in the stomach wall of mammals. ↑ PEPTIC CELLS

CM041 adenitis (*n.*) Inflammation of glands. ↑ GLAND

CM042 glandular (*adj.*) Of or to do with glands; the term describes any structure with a secreting function. ↓ NON-GLANDULAR (An)

CM043 non-glandular (*adj.*) Describes epithelial tissue which does not produce secretions. ↑ GLANDULAR (An) → SECRETION[1]

CM044 exocrine (*adj.*) (In animals) describes a gland with a duct to drain glandular secretions and discharge them to an epithelial surface, either to the outer surface of the body, or to the lumen of the gut. Most glands are exocrine. ↓ ENDOCRINE (An) · HOLOCRINE (H) · MEROCRINE (H) · APOCRINE (H) · ECCRINE (H) ↑ GLAND

CM045 endocrine (*adj.*) (In animals) describes a gland without a duct; an endocrine gland secretes minute quantities of hormones into the bloodstream. ↑ EXOCRINE (An) → DUCTLESS GLANDS · HORMONE

CM046 holocrine (*adj.*) Describes an exocrine gland in which the secretion accumulates in a glandular cell; the cell then disintegrates and becomes part of the secretion, *e.g.* sebaceous glands. **2** Describes the secretion from such a gland. ↑ EXOCRINE → SEBACEOUS GLANDS

CM047 merocrine (*adj.*) Describes an exocrine gland in which glandular cells remain intact during secretion, *e.g.* salivary glands and the pancreas. Most exocrine glands are merocrine. ↑ EXOCRINE

CM048 apocrine (*adj.*) Describes an exocrine gland in which part of a glandular cell is utilized in the secretion; the basal nucleated portion regenerates a whole cell, *e.g.* mammary glands are apocrine. ↑ EXOCRINE

CM049 eccrine (*adj.*) Alternative term for MEROCRINE (↑).

Connecting Tissue

CN001 connective tissue (*n.*) Various vertebrate body tissues which bind together and support organs and other tissues, *e.g.* connective tissue surrounds muscles and nerves, connects bones and muscles and underlies the skin. Cartilage and bone are also connective tissues. Typical connective tissue consists of cells scattered in an amorphous mucopolysaccharide matrix in which there are varying amounts of connective tissue fibres (mainly collagen, but also elastin and reticulin). ↓ WHITE FIBROUS TISSUE · MATRIX · CARTILAGE · BONE · HAVERSIAN CANAL · OSSIFICATION → TISSUE

CN002 white fibrous tissue (*n.*) (In vertebrates) a connective tissue which consists of a matrix of very fine white wavy fibres, arranged parallel to each other, in bundles and unbranching, with fibroblasts embedded in the bundle. The tissue is tough and inelastic. It is found pure in tendons. The white fibres are composed of collagen. ↓ YELLOW ELASTIC TISSUE · RETICULAR TISSUE · AREOLAR TISSUE · MESENCHYME · ADIPOSE TISSUE · FAT CELL ↑ CONNECTIVE TISSUE → FASCIA · FIBRES[2] · COLLAGEN

CN003 yellow elastic tissue (*n.*) (In vertebrates) a connective tissue which consists of a matrix of coarse yellow elastic fibres which branch regularly and anastomose, with fibroblasts in the matrix. Elastin is the principal constituent of this tissue. The tissue rarely occurs pure and usually contains white fibres as well. Yellow elastic fibres are numerous in the lungs and in the walls of arteries, where elastic supporting tissues are required. Yellow elastic tissue occurs in ligaments, where an extensible tissue is

required. ↑ WHITE FIBROUS TISSUE → FIBRES[2] · ELASTIN

CN004 reticular tissue (*n.*) A vertebrate tissue consisting of a network of reticular fibres around and amongst cells with lymph in the intercellular spaces. It occurs in muscles, nerves and the larger glands. ↑ WHITE FIBROUS TISSUE → RETICULIN FIBRES

CN005 areolar tissue (*n.*) (In vertebrates) a soft, sometimes sponge-like connective tissue which consists of an amorphous polysaccharide-containing, and jelly-like ground matrix in which a loose network of white fibres, yellow fibres, and reticulin fibres is embedded. Fibroblasts in the matrix form and maintain the matrix. Areolar tissue is found all over the vertebrate body, binding together organs (by mesenteries) and muscles (by sheaths), and occurring as subcutaneous tissues. Its function is supporting or filling in space between organs or between other tissues. The fibrous nature of the matrix is modified by variation in the concentration of white, yellow or reticulin fibres; this alters the characteristics of toughness, elasticity, and inextensibility to suit the function of the tissue. Many modifications of areolar tissue occur. ↑ WHITE FIBROUS TISSUE

CN006 mesenchyme (*n.*) Mesodermal tissue consisting of widely-scattered, branching cells in a jelly-like matrix; it occurs in an embryo and gives rise to blood, bone, cartilage and connective tissues. —***mesenchymal*** (*adj.*) ***mesenchymatous*** (*adj.*) ↑ WHITE FIBROUS TISSUE

CN007 adipose tissue (*n.*) A modification of areolar tissue in which globules of oil are deposited in some of the cells (fat cells). The cells tend to be grouped together, and in mammals occur in the tissues under the skin, around the kidneys, etc. ↑ WHITE FIBROUS TISSUE

CN008 fat cell (*n.*) (In animals) a cell in which a food reserve, in the form of droplets of oil, is deposited in a cell; the quantity of oil increases until the oil globule, so formed, distends the cell and pushes the nucleus and cytoplasm to one side. A collection of fat cells forms adipose tissue in some vertebrates, and fatty bodies in other animals. ↑ WHITE FIBROUS TISSUE → CELL

CN009 matrix (*n., pl.* **matrices**) **1** A non-living, intercellular material, in which cells are embedded; the material may be composed of one or more different substances. Cells secrete the substances of the matrix, and thereafter may play a negligible part in the work of the tissue. Matrices occur in connective tissues. **2** The material upon which a fungus or lichen grows. **3** The part of a tissue beneath the body and root of a nail. **4** An alternative term for UTERUS. ↓ FIBROBLAST · COLLAGEN · KERATIN · CHONDRIN · SCLEROSIS · CALCAREOUS ↑ CONNECTIVE TISSUE

CN010 fibroblast (*n.*) A cell of an irregular, branching shape; it is found distributed throughout vertebrate connective tissue. It forms and maintains collagen and other scleroproteins in the tissue. ↓ SCLEROPROTEINS · FIBRES[2] · RETICULIN FIBRES ↑ MATRIX → CELL

CN011 scleroproteins (*n.pl.*) A group of proteins, insoluble in water or salt solutions, and of a fibrous nature. They are present in the form of supporting fibres in animals either as surface coverings *e.g.* keratin and collagen, or as fibres binding cells together *e.g.* elastin and collagen. ↑ FIBROBLAST

CN012 fibres[2] (*n.pl.*) Long strands of scleroprotein; either collagen forming white fibres or elastin forming yellow fibres, or reticulin forming reticular fibres. Fibres form part of a non-cellular matrix around and amongst cells; they are formed and maintained in a tissue by fibroblasts. A matrix may consist of an amorphous, jelly-like polysaccharide, together with the three types of fibre. Cells and a matrix together form a connective tissue. Different forms of connective tissue possess varying proportions of the constituents of the matrix. ↑ FIBROBLAST

CN013 reticulin fibres (*n.pl.*) Very thin, almost inextensible threads of reticulin; they form a network of intercellular fibres around and amongst the cells of many vertebrate tissues, *e.g.* in many large organs such as the liver and kidney, and also in tissues such as nerves and muscles. They especially support and unite reticular tissue. ↑ FIBROBLAST

CN014 collagen (*n.*) A tough, inelastic, fibrous protein; on boiling it forms gelatin; on adding acetic acid it swells up and dissolves. Collagen is formed and maintained in tissues by fibroblasts. It forms white fibres in vertebrate connective tissue. The cuticle of some invertebrates, *e.g.* earthworms, is a similar protein. —***collagenous*** (*adj.*) ↓ ELASTIN · RETICULIN · OSSEIN · SPONGIN ↑ MATRIX

CN015 elastin (*n.*) An elastic fibrous protein, resistant to boiling and to acetic acid; it forms highly elastic yellow fibres in vertebrate connective tissue. Elastin is formed and maintained in tissues by fibroblasts. ↑ COLLAGEN

CN016 reticulin (*n.*) A tough fibrous protein, similar to collagen, but more resistant to higher temperatures and chemical reagents, occurring in vertebrate connective tissue as reticulin fibres. Reticulin is formed in embryos and also in wounds; it often changes to collagen. ↑ COLLAGEN

CN017 ossein (*n.*) Bone collagen; it is obtained by dissolving out the calcium salts from bone tissue, using hydrochloric acid. ↑ COLLAGEN

CN018 spongin (*n.*) A fibrous protein, resembling collagen, which forms interlocking elastic fibres as a matrix for different types of cells which are embedded in it. Spongin forms the skeleton of some sponges, *e.g.* Porifera. Bath sponge is the cleaned skeleton of one of these sponges. ↑ COLLAGEN → PORIFERA

CN019 keratin (*n.*) A tough fibrous protein which contains sulphur; it is found in the epidermis of vertebrates, and forms the protective and resistant outermost layer of the skin. The epidermal cells are transformed into keratin. Hair, feathers, nails, claws, hooves and horny scales are composed of keratin. The outer coating of the horns of sheep, cattle, etc., is composed of keratin. —KERATINIZATION (*n.*) ***keratinize*** (*v.*) ↓ CHITIN · FUNGINE ↑ MATRIX

CN020 chitin (*n.*) A white, horn-like, nitrogen-containing polysaccharide which has long fibrous molecules. It forms a material which has great mechanical strength, and resistance to chemical attack. It occurs in the exoskeleton and tracheae of arthropods, and is a constituent of the cell wall in fungi. —***chitinous*** (*adj.*) ↑ KERATIN → ARTHROPOD · FUNGUS

CN021 fungine (*n.*) A substance, similar to chitin, forming the cell wall of fungi. ↑ KERATIN

CN022 chondrin (*n.*) A mixture of gelatin and mucoproteins (polysaccharide-containing proteins). Chondrin is yielded by boiling cartilage. ↓ CARTILAGE ↑ MATRIX · COLLAGEN → MUCOPROTEIN

CN023 sclerosis (*n.*) The process of hardening, or the condition of having become hard, *e.g.* ***a*** the sclerosis of plant cell-walls by lignification; ***b*** the sclerosis of a vertebrate tissue after injury, caused by an increase in the concentration of collagen in the tissue; ***c*** sclerosis of the arteries, by which elasticity of the artery is lost. —***sclerose*** (*v.*) ***sclerosed***, SCLEROTIC (*adj.*) ↓ KERATINIZATION · CORNIFICATION ↑ MATRIX → LIGNIFICATION · SUBERIZATION

CN024 keratinization (*n.*) The process by which the protoplasm of epidermal cells becomes entirely replaced by keratin, producing a dead, horny cell. ↑ SCLEROSIS

CN025 cornification (*n.*) Alternative term for KERATINIZATION.

CN026 calcareous (*adj.*) Describes a tissue or non-living structure which has chalk or any other calcium salt in its chemical material, *e.g.* ***a*** the shell of a mollusc is calcareous; it is composed of chalk and other substances; ***b*** the bones of vertebrates are calcareous. Contrast **calcareous** with **calcified**: a bone is calcareous (describing its state of containing calcium salts); a bone becomes calcified (describing the process of assimilating calcium salts into the matrix). ↓ SILICEOUS ↑ MATRIX

CN027 siliceous (*adj.*) Describes a tissue or non-living structure which has silica in its chemical material, *e.g.* the spicules of some sponges are siliceous as they have been hardened by assimilation of silica. ↑ CALCAREOUS → SILICA

CN028 chitinous (*adj.*) Describes a structure composed of chitin, *e.g.* the chitinous cuticle of insects. ↑ CALCAREOUS · CHITIN

CN029 cartilage (*n.*) Gristle; a strong, resilient, skeletal tissue in vertebrates. Its simplest and most common form consists of a matrix of a polysaccharide-containing protein, in which are embedded cartilage cells (chondroblasts). The matrix is without structure, and without blood-vessels. This type is known as **hyaline cartilage**; it is translucent and clear, and occurs in the cartilaginous rings of the trachea and bronchi. **Calcified cartilage** is stiffened by the impregnation of the matrix with calcium carbonate. It occurs in the larger Elasmobranchs, *e.g.* sharks, and forms the entire endoskeleton. **Elastic cartilage** contains yellow fibres in the matrix; it occurs in the external ear of mammals and in the epiglottis. Also known as ***yellow fibro-cartilage.*** **Fibro-cartilage** contains white fibres in the matrix. It occurs in the discs of cartilage between the vertebrae of mammals; it is also known as ***white fibro-cartilage.*** All types of cartilage contain chondroblasts which deposit the matrix and become enclosed in the matrix as chondrocytes. ↓ HYALINE CARTILAGE · CHONDROCYTE · CHONDROGENESIS · PERICHONDRIUM · CARTILAGINOUS ↑ CONNECTIVE TISSUE → CHONDRIN · CARTILAGE BONE

CN030 hyaline cartilage (*n.*) See CARTILAGE. ↓ CALCIFIED CARTILAGE · ELASTIC CARTILAGE · YELLOW FIBRO-CARTILAGE · FIBRO-CARTILAGE · WHITE FIBRO-CARTILAGE ↑ CARTILAGE → TRACHEA[1] · BRONCHUS

CN031 calcified cartilage (*n.*) See CARTILAGE(↑).

CN032 elastic cartilage (*n.*) See CARTILAGE (↑). ↑ HYALINE CARTILAGE → PINNA[3] · EPIGLOTTIS

CN033 yellow fibro-cartilage (*n.*) See CARTILAGE (↑). ↑ HYALINE CARTILAGE

CN034 fibro-cartilage (*n.*) See CARTILAGE (↑). ↑ HYALINE CARTILAGE

CN035 white fibro-cartilage (*n.*) Alternative term for FIBRO-CARTILAGE.

CN036 chondrocyte (*n.*) A cell in a lacuna in cartilage; it is surrounded by a relatively dense matrix forming a capsule about the lacuna. ↓ CARTILAGE CELL · CHONDROBLAST · CHONDROCLAST ↑ CARTILAGE → LACUNA[2] · MATRIX

CN037 cartilage cell (*n.*) Alternative term for CHONDROCYTE. ↑ CHONDROCYTE

CN038 chondroblast (*n.*) A cell actively secreting the matrix which forms cartilage; it later becomes enclosed in the matrix as a chondrocyte. ↑ CHONDROCYTE

CN039 chondroclast (*n.*) A large multinucleate cell which destroys the matrix of cartilage. ↑ CHONDROCYTE

CN040 chondrogenesis (*n.*) The production or formation of the matrix of cartilage, *e.g.* chondroblasts carry out chondrogenesis as their main function. ↓ CALCIFICATION ↑ CARTILAGE → MATRIX

CN041 calcification (*n.*) The hardening of plant or animal tissues by the deposition of calcium salts in the tissue, *e.g.* the calcification of cartilage to form calcified cartilage. —***calcified*** (*adj.*) CALCIFY (*v.*) ↑ CHONDROGENESIS

CN042 perichondrium (*n.*) A dense, fibrous

membrane of connective tissue covering cartilage; it supplies nutriment to the cartilage by a process of slow diffusion, as cartilage in adults has no blood vessels. —***perichondrial*** (*adj.*) ↑ CARTILAGE

CN043 cartilaginous (*adj.*) Consisting of, containing or resembling the consistency of cartilage. ↓ CHONDRAL ↑ CARTILAGE

CN044 chondral (*adj.*) Of or to do with cartilage. ↑ CARTILAGINOUS

CN045 bone (*n.*) (In most vertebrates) a connective tissue forming the skeleton. It consists of cells embedded in a matrix of bone salts and collagen fibres. The bone salts (mostly calcium carbonate and phosphate) form about 60% of the mass of the bone and give it its tensile strength. The bone cells are interconnected by fine protoplasmic processes situated in narrow channels in the bone, and are nourished by the blood stream. This vascular nature of bone differentiates it from cartilage. —***bony*** (*adj.*) ↓ COMPACT BONE · PERIOSTEUM · MARROW · OSTEITIS · OSSEOUS ↑ CONNECTIVE TISSUE → OSTEOCYTE

CN046 compact bone (*n.*) The hard surface of bones which have to be strong, *i.e.* nearly all skeletal bones; it occurs in most adult vertebrates. It consists of a hard matrix pierced by canals of different sizes, with osteocytes situated in the smaller canals. It is found in membrane bones, and on the external surfaces of cartilage bone. ↓ SPONGY BONE · CARTILAGE BONE · MEMBRANE BONE · PERICHONDRAL BONE · SESAMOID BONE ↑ BONE → HAVERSIAN CANAL

CN047 spongy bone (*n.*) Spongy bone occurs in the bones of most young vertebrates and in the interior of cartilage bones of adults. It consists of a framework of bars of bone called trabeculae, arranged in a structure similar to that of a sponge; between the trabeculae are situated other tissues, *e.g.* vascular and fatty tissues, which form red bone marrow. Spongy bone is the first stage of ossification in cartilage bones. ↓ HAVERSIAN SPACES ↑ COMPACT BONE → TRABECULAE

CN048 cartilage bone (*n.*) An embryo of a vertebrate has skeletal structures of cartilage; they are miniatures of adult bones. Endochondral ossification begins shortly after the formation of the cartilage structures. Firstly the cartilage becomes calcified, the cartilage cells die, and osteoclasts penetrate the cartilage forming channels into which vascular vessels extend. Secondly osteoblasts are brought by the blood stream, and deposit successive layers of bone from a centre of ossification. The first bone tissue formed is spongy bone; this extends as ossification proceeds, and compact bone is formed round the peripheral surfaces. The final result is a peripheral tissue of compact bone, enclosing a mass of spongy bone, and in some long bones, a hollow, called a medullary canal. Most of the bones of the vertebrate skeleton are cartilage bones, *e.g.* long bones and vertebrae. ↓ MEDULLARY CANAL ↑ COMPACT BONE → CARTILAGE · OSTEOCLAST · OSTEOBLAST

CN049 membrane bone (*n.*) Osteoblasts develop in connective tissue, usually in the dermis, or lower layer of the skin. Intramembranous ossification forms plates of bone. In mammals, the bones of the face and skull are membrane bones. In fishes membrane bones form scales; in some reptiles they form bony plates covered by skin; in turtles they form the armour. Membrane bones have the same structure as compact cartilage bone; the difference is one of origin only. ↑ COMPACT BONE

CN050 perichondral bone (*n.*) Bone tissue formed by osteoblasts in periosteum; this ossification thickens the shaft and shapes a long bone. ↑ COMPACT BONE ↓ PERIOSTEUM

CN051 sesamoid bone (*n.*) A small bone formed in a tendon near a joint, *e.g.* the patella. ↑ COMPACT BONE

CN052 periosteum (*n.*) A membrane of dense connective tissue tightly covering bones; it is richly supplied with blood vessels; tendons and muscles are attached to the periosteum. In young vertebrates, it contains active osteoblasts, and in adult vertebrates, potential osteoblasts. The active osteoblasts form perichondral bone, the potential osteoblasts repair bones after fracture. The periosteum protects and nourishes the bone from its vascular system. —***periosteal*** (*adj.*) ↓ MEDULLARY CANAL · MEDULLARY MEMBRANE · ENDOSTEUM ↑ BONE → OSTEOBLAST

CN053 medullary canal (*n.*) The hollow in the middle of the shaft of a mammalian long bone; it contains yellow marrow. It is formed by the action of osteoclasts in cartilage bone. ↑ PERIOSTEUM

CN054 medullary membrane (*n.*) A membrane of connective tissue lining the medullary canal of a long bone. ↑ PERIOSTEUM

CN055 endosteum (*n.*) Alternative term for MEDULLARY MEMBRANE.

CN056 marrow (*n.*) A connective tissue which fills the internal spaces in mammalian bones; there are two varieties, yellow and red marrow. ↓ YELLOW MARROW · RED MARROW ↑ BONE

CN057 yellow marrow (*n.*) Marrow consisting of a large proportion of adipose tissue; fats are stored, and blood cells made, in yellow marrow. It is found in the medullary canal of a mammalian long bone. ↑ MARROW · MEDULLARY CANAL → ADIPOSE TISSUE

CN058 red marrow (*n.*) Marrow containing various types of cells; it is important as the site of manufacture of red blood cells. It is found in spongy bone and fills the Haversian spaces. ↑ MARROW ↓ HAVERSIAN SPACES

CN059 osteitis (*n.*) Inflammation in bone tissue. ↓ OSTEOMYELITIS · OSTEOMALACIA[1] ↑ BONE

CN060 osteomyelitis (*n.*) Inflammation of a bone and its marrow; usually inflammation of the diaphysis. ↑ OSTEITIS

CN061 osteomalacia[1] (*n.*) A deficiency disease in which the bones become soft

because of a lack of calcium in the diet. A shell of compact bone is left surrounding the decalcified internal bone structure. ↑ OSTEITIS → RICKETS

CN062 osseous (*adj.*) Composed of bone tissue; bone-like in appearance. ↓ OSSIFIED ↑ BONE

CN063 ossified (*adj.*) Changed to bone, *e.g.* ***a*** ossified cartilage in cartilage bone; ***b*** ossified membranes in the pinna. ↑ OSSEOUS

CN064 Haversian canal (*n.*) A channel passing through compact bone; it carries blood vessels and nerves to the living cells in bone. Haversian canals communicate with each other and ramify throughout the bone structure. The diameter of a canal is about 50 μm. ↓↑LAMELLA[2] · BONE CELL · LACUNAR[2] ↑ CONNECTIVE TISSUE · BONE

CN065 lamella[2] (*n.,pl.* **lamellae**) A thin layer of bone matrix; lamellae are either arranged concentrically round a Haversian canal, or arranged parallel to the surface of a bone. A lamella is about 5 μm thick. —LAMELLATE, LAMELLAR (*adj.*) ↓ LACUNA[2] · CANALICULUS[2] · HAVERSIAN SYSTEM · HAVERSIAN SPACES ↑ HAVERSIAN CANAL

CN066 lacuna[2] (*n.,pl.* **lacunae**) **1** A minute space between the lamellae of compact bone. Bone cells, or osteocytes, are situated in the lacunae. Lacunae are geometrically arranged round a Haversian canal, or are arranged parallel to a bone surface. **2** A minute space surrounding a cartilage cell, and enclosed by cartilage. —***lacunar, lacunose*** (*adj.*) ↑ LAMELLA[2] ↓ OSTEOCYTE

CN067 canaliculus[2] (*n.,pl.* **canaliculi**) A very narrow channel connecting lacunae in compact bone. The lamellae of bones are pierced by canaliculi; fine protoplasmic threads from osteocytes extend into the canaliculi. ↑ LAMELLA[2]

CN068 Haversian system (*n.*) A Haversian canal surrounded by concentric layers of bony tissue (lamellae), interspersed with lacunae containing bone cells. ↑ LAMELLA[2]

CN69 Haversian spaces (*n.pl.*) Relatively large spaces between the trabeculae of spongy bone; they are filled with red bone marrow. The Haversian spaces of spongy bone correspond to the Haversian canals of compact bone; as spongy bone is much lighter and less strong than compact bone, the spaces are large and the actual bone matrix small in extent. ↑ LAMELLA[2] → SPONGY BONE

CN070 bone cell (*n.*) Alternative term for OSTEOCYTE. ↓ OSTEOCYTE · OSTEOBLAST · OSTEOCLAST ↑ HAVERSIAN CANAL

CN071 osteocyte (*n.*) A living cell embedded in compact bone; the cell has stopped dividing and stopped forming bone matrix. It is situated in a lacuna, and has fine protoplasmic processes which radiate through the matrix. These processes extend into canaliculi so that all the osteocytes of a Haversian system are in contact through these processes with members of their own system and with members of adjacent systems. ↑ BONE CELL

CN072 osteoblast (*n.*) A cell actively secreting material to form bone matrix. When the lamellae between osteoblasts are fully formed, the osteoblasts stop their secretion and develop into osteocytes. ↑ BONE CELL · LAMELLA[2]

CN073 osteoclast (*n.*) A large, multinucleate cell which destroys or absorbs bone matrix or cartilage. The matrix of bones is being constantly destroyed and reformed to remodel the bone shape, especially during bone growth. The osteoclasts form the channels in cartilage which develop into Haversian canals and Haversian spaces. ↑ BONE CELL → MEDULLARY CANAL

CN074 lacunar[2] (*adj.*) Of, to do with, or resembling lacunae. ↓ LACUNOSE ↑ HAVERSIAN CANAL

CN075 lacunose (*adj.*) Having many lacunae, or having many small cavities. ↑ LACUNAR[2]

CN076 ossification (*n.*) The process of cartilage or membrane being replaced by bone tissue; the formation of bone tissue. Ossification is **endochondral** or **perichondral** or **intramembranous**. For endochondral ossification see CARTILAGE BONE. ↓ CENTRE OF OSSIFICATION · OSTEOLYSIS (An) · OSSIFY · ENDOCHONDRAL ↑ CONNECTIVE TISSUE

CN077 centre of ossification (*n.*) A point at which osteoblasts start to lay down a bone matrix. The cartilage of most bones starts to ossify at the middle of the bone and ossification continues to either end of the structure; this forms the diaphysis of cartilage bone. Secondary, or accessory centres of ossification can also be set up; these form the epiphyses of cartilage bone. ↓ DIAPHYSIS · EPIPHYSIS · EPIPHYSEAL CARTILAGE ↑ OSSIFICATION

CN078 diaphysis (*n.,pl.* **diaphyses**) A zone of ossification which increases on either side of the centre of ossification of a long bone; it is the central part of a vertebra or of the shaft of a long bone. The ossification gradually extends until the whole bone has been converted from cartilage to bony tissue. —***diaphyseal*** (*adj.*) ↑ CENTRE OF OSSIFICATION

CN079 epiphysis[2] (*n.,pl.* **epiphyses**) A part of a bone formed from an accessory or secondary centre of ossification; it is usually the end of a bone, and peculiar to the vertebrae and long bones of mammals. Epiphyses are especially found in articulating surfaces of joints and in points of attachment for muscles and tendons. The epiphysis of growing bones is separated from the diaphysis by a plate of cartilage. —***epiphyseal*** (*adj.*) ↑ CENTRE OF OSSIFICATION

CN080 epiphyseal cartilage (*n.*) A plate of cartilage separating the diaphysis of a mammalian bone from an epiphysis. The bone grows in length by ossification of the cartilage plate on the diaphyseal side and formation of new cartilage on the epiphyseal side. When growth of the bone is

complete, diaphysis and epiphysis fuse, and the epiphyseal cartilage disappears. ↑ CENTRE OF OSSIFICATION

CN081 osteolysis (*n.*) The process of the destruction or absorption of bone, *e.g.* osteoclasts perform osteolysis. Osteolysis and ossification take place continually in bone tissues; under normal conditions the two processes are in equilibrium in adults. —***osteolytic*** (*adj.*) ↑ OSSIFICATION (An)

CN082 ossify (*v.t.,i.*) **1** (*v.t.*) To replace cartilage, or dermis, by bone tissue. **2** (*v.i.*) To become bone —OSSIFICATION (*n.*) OSSIFIED, OSSEOUS (*adj.*) ↑ OSSIFICATION

CN083 endochondral (*adj.*) (Of a bone) ossified from the inside outwards; the term describes the ossification of cartilage from a centre of ossification. See CARTILAGE BONE □ *the ossification of a long bone in vertebrates is endochondral* ↓ PERICHONDRAL (An) · OSTEOLYTIC ↑ OSSIFICATION

CN084 perichondral (*adj.*) (Of a bone) ossified from the outside inwards; the term describes ossification by the osteoblasts in periosteum or on top of cartilage. ↑ ENDOCHONDRAL (An) → PERIOSTEUM

CN085 osteolytic (*adj.*) Describes the action of osteolysis, *e.g.* osteoclasts have an osteolytic action. ↑ ENDOCHONDRAL

Muscular Tissue

CP001 muscular tissue (*n.*) A tissue characterized by its ability to contract on being stimulated by a motor nerve. There are three main types of muscular tissue forming three types of muscles: striped muscle, unstriped muscle, cardiac muscle. ↓ MYOBLAST · MYOPLASM · MYONEME · ACTOMYOSIN · MUSCLE · STRIPED MUSCLE · UNSTRIPED MUSCLE · CARDIAC MUSCLE → TISSUE

CP002 myoblast (*n.*) A cell which develops into a muscle fibre. ↓ MYOTOME[1] · SARCOSOMES ↑ MUSCULAR TISSUE

CP003 myotome[1] (*n.*) (In vertebrates) the part of the somatic mesoderm of embryos which develops into striped muscle. ↑ MYOBLAST

CP004 sarcosomes (*n.pl.*) Mitochondria occurring in muscle cells and fibres. ↑ MYOBLAST → MITOCHONDRION

CP005 myoplasm (*n.*) The contractile protoplasm of a muscle fibre or cell, as opposed to the sarcoplasm, which is the interstitial protoplasm. ↓ SARCOPLASM · MYOFIBRILS · SARCOSTYLES · SARCOMERE

CP006 sarcoplasm (*n.*) See MUSCLE FIBRE (CP035) for sacroplasm in striped muscle, and MUSCLE CELL (CP054) for sarcoplasm in unstriped muscle. ↑ MYOPLASM

CP007 myofibrils (*n.pl.*) **1** Striated contractile fibrils in a muscle fibre. **2** Unstriated contractile fibres in muscle cells. Also called ***myofibrillae***. ↑ MYOPLASM

CP008 sarcostyles (*n.pl.*) Alternative term for MYOFIBRILS.

CP009 sarcomere (*n.*) The individual unit of a myofibril; it is a transverse portion between intermediate discs on a myofibril. Each sarcomere contains the contractile apparatus of the fibril, which depends on the interaction of actin and myosin. ↑ MYOPLASM

CP010 myoneme (*n.*) A contractile fibril found in many Protozoa. ↑ MUSCULAR TISSUE → MYOID · MUSCULO-EPITHELIAL CELL

CP011 actomyosin (*n.*) A substance consisting of two proteins, actin and myosin. It is the most important constituent of muscle. Muscle fibres are mainly composed of actomyosin. ↓ SARCOLACTIC ACID ↑ MUSCULAR TISSUE

CP012 sarcolactic acid (*n.*) An isomer of lactic acid produced in striped muscles after a series of contractions. Sustained contractions produce an accumulation of sarcolactic acid in the muscles, causing the sensation of fatigue. ↑ ACTOMOYSIN

CP013 muscle (*n.*) An organ of movement which is highly contractile, extensible and elastic; it is composed of muscular tissue. A muscle contracts and relaxes; it can also be stretched beyond its normal length, and return to its original length and shape when the stretching force is removed. The edible portion (flesh) of an animal is mostly muscle. —MUSCULATURE (*n.*) MUSCULAR (*adj.*) ↓ MYOGENESIS · MUSCULAR CONTRACTION · TWITCH · TETANUS · MUSCULAR ↑ MUSCULAR TISSUE

CP014 myogenesis (*n.*) The development of muscles. ↓ MUSCULATURE · MYOTOME[2] ↑ MUSCLE

CP015 musculature (*n.*) The system of muscles, their positions and functions in an animal, or in part of an animal, *e.g.* ***a*** the musculature of a rabbit; ***b*** the musculature of an arm. ↑ MYOGENESIS

CP016 myotome[2] (*n.*) (In invertebrates) the musculature of a metamere. ↑ MYOGENESIS → METAMERE

CP017 muscular contraction (*n.*) The action of a muscle when stimulated by a motor nerve so that its tension increases, its length decreases, and its width increases, so that the overall volume remains the same. Normal muscular contractions are usually intermediate between isometric and isotonic contractions. All body movements of animals are caused by muscular contractions acting on body structures. Prolonged contractions or continual contractions of striped muscle cause the sensation of fatigue; unstriped muscle is capable of sustained contraction without fatigue. The end-plates of motor neurons cause contractions of muscle fibres, and the fibres react according to the all-or-none law.

—CONTRACTILITY (*n.*) ↓ CONTRACTILITY · ISOTONIC CONTRACTION · ISOMETRIC CONTRACTION · RELAXATION ↑ MUSCLE → ALL-OR-NONE LAW

CP018 contractility (*n.*) The disposition of muscular tissue to contract. ↑ MUSCULAR CONTRACTION

CP019 isotonic contraction (*n.*) If the length of a muscle decreases, but the tension remains the same, an isotonic contraction takes place. ↑ MUSCULAR CONTRACTION

CP020 isometric contraction (*n.*) When the two ends of a muscle do not move, so that the length of the muscle remains the same, an isometric contraction takes place; the tension in the muscle increases. ↑ MUSCULAR CONTRACTION

CP021 relaxation (*n.*) The action of a muscle immediately after contraction, during which it returns to its normal state of length or tension. Muscular contractions and relaxations take place against a background of tonus. —***relaxed*** (*adj.*) ***relax*** (*v.*) ↓ TONUS[2] ↑ MUSCULAR CONTRACTION

CP022 twitch (*n.*) A single contraction of a muscle, caused by a single stimulus. The muscle contracts a fraction of a second after the stimulus is applied (the latent period). A period of contraction follows, during which the contraction reaches a maximum, then immediately follows a period of relaxation, during which the muscle returns to normal. —***twitching*** (*adj.*) TWITCH (*v.*) ↓ LATENT PERIOD · TONUS[2] · MUSCLE TONE · SPASM ↑ MUSCLE

CP023 latent period (*n.*) The period between the application of a stimulus and the contractile response of a muscle. During this period, the muscle is refractory to other stimuli, *i.e.* no response will occur. ↑ TWITCH → REFRACTORY[2]

CP024 tonus[2] (*n.*) A condition of partial contraction, or slight tension in a muscle, produced by continuous nervous stimulation, *e.g.* ***a*** striped muscle attached to vertebrate skeletons is normally in a state of tonus to maintain the posture of the animal; only some of the muscle fibres are contracted, sufficient to maintain the tension in the muscle; ***b*** unstriped muscle is in a state of tonus to maintain the shape of a hollow organ. ↑ TWITCH

CP025 muscle tone (*n.*) Alternative term for TONUS of a muscle.

CP026 spasm (*n.*) A sudden involuntary contraction of a muscle, intense in effect, but of short duration. ↑ TWITCH

CP027 tetanus (*n.*) **1** The state of a muscle undergoing a long, violent, unbroken contraction, caused by a number of different stimuli including electric stimulation, *e.g.* an electric shock can produce tetanus in a muscle. **2** A disease caused by a bacillus from the soil entering a wound; the symptoms are tetanus of the muscles of the mouth, causing great pain, and frequently resulting in death. —***tetanize*** (*v.*) ***tetanic*** (*adj.*) ↑ MUSCLE → TETANY

CP028 muscular (*adj.*) Of or to do with muscles; possessing well-developed muscles. ↓ FLABBY · MUSCLE BOUND ↑ MUSCLE

CP029 flabby (*adj.*) Describes the condition of a muscle when tonus stops. ↑ MUSCULAR

CP030 muscle-bound (*adj.*) Describes a condition in which muscles have lost their elasticity, caused by over-use. ↑ MUSCULAR

CP031 striped muscle (*n.*) (In vertebrates) a contractile tissue composed of muscle fibres, with numerous striations in the cytoplasm, and containing many nuclei. The striations are conspicuous and are at right angles to the muscle fibre. The contractions of striped muscle cause movement of the skeleton; the muscle is capable of very rapid contraction. Striped muscle is also known as voluntary muscle as it is controlled by voluntary action. ↓ STRIATED MUSCLE · MUSCLE FIBRE · END-PLATE · TENDON · MYOID ↑ MUSCULAR TISSUE

CP032 striated muscle (*n.*) Alternative term for STRIPED MUSCLE. ↓ SKELETAL MUSCLE · VOLUNTARY MUSCLE ↑ STRIPED MUSCLE

CP033 skeletal muscle (*n.*) Alternative term for STRIPED MUSCLE. ↑ STRIATED MUSCLE

CP034 voluntary muscle (*n.*) Alternative term for STRIPED MUSCLE. ↑ STRIATED MUSCLE

CP035 muscle fibre (*n.*) The individual unit of a striped muscle. It is composed of a large number of myofibrils arranged parallel to each other and to the fibre, and enclosed in a transparent sheath. The myofibrils are closely packed in interstitial protoplasm, called sarcoplasm. A muscle fibre is about 50 μm in diameter, is striped in appearance, and each one contains hundreds of nuclei. ↓ SARCOLEMMA · MYOLEMMA · FASCICULI · ENDOMYSIUM · PERIMYSIUM · EPIMYSIUM ↑ STRIPED MUSCLE

CP036 sarcolemma (*n.*) The thin, tubular, transparent sheath of a muscle fibre. ↑ MUSCLE FIBRE

CP037 myolemma (*n.*) Alternative term for a SARCOLEMMA. ↑ MUSCLE FIBRE

CP038 fasciculi (*n.pl., sing.* **fasciculus**) A bundle of muscle fibres; the fibres are bound together by membranes of connective tissue, called endomysia. —FASCICULAR, FASCICULATE (*adj.*) ↑ MUSCLE FIBRE

CP039 endomysium (*n., pl.* **endomysia**) See FASCICULI. ↑ MUSCLE FIBRE

CP040 perimysium (*n.*) A sheath of elastic connective tissue binding muscle fibres into a fasciculus; the outer sheath of a fasciculus. ↑ MUSCLE FIBRE

CP041 epimysium (*n.*) A sheath of elastic connective tissue binding fasciculi together to form an entire muscle. ↑ MUSCLE FIBRE

CP042 end-plate (*n.*) The plate-like end-organ of a motor neuron; the end of a motor neuron attached to a muscle fibre through which is transmitted the nervous impulse to the muscle fibre causing it to contract. ↑ STRIPED MUSCLE → END-ORGAN

CP043 tendon (*n.*) A cord of white fibrous tissue; it usually attaches muscles to bones. ↑ STRIPED MUSCLE

CP044 myoid (*adj.*) Resembling muscle fibres; the term usually describes contractile structures or tissues composed of muscle fibres. ↓ NEUROMYAL · FASCICULAR[1] · FASCICULATE · NEUROMUSCULAR · MYONEURAL ↑ STRIPED MUSCLE

CP045 neuromyal (*adj.*) Concerned with the junction of nerves and muscles, as at the end-plates. ↑ MYOID

CP046 fascicular[1] (*adj.*) Of or to do with fasciculi, *e.g.* the fascicular membranes of a muscle are those binding it together, and those enclosing it. ↑ MYOID

CP047 fasciculate (*adj.*) Possessing or being composed of fasciculi, *e.g.* the striped muscle of vertebrates is fasciculate in structure. ↑ MYOID

CP048 neuromuscular (*adj.*) Of or to do with muscles and nerves acting together, *e.g.* the neuromuscular system of an animal. —***neuromusculature*** (*n.*) ↑ MYOID

CP049 myoneural (*adj.*) Alternative term for NEUROMYAL. ↑ MYOID

CP050 unstriped muscle (*n.*) (In vertebrates) a tissue composed of individual muscle cells with no striations in the cells. The cells are bound together by connective tissue fibres. It is mainly present in flat sheets of muscle or in sheets of muscle surrounding hollow organs, such as blood vessels or the alimentary canal; it is under the control of the autonomic nervous system, contracts at a slower rate than striped muscle, and has the ability to undergo sustained contraction of varying degree, *i.e.* tonus is readily maintained. Sheets of unstriped muscle have the ability to conduct a wave of muscular contraction, as in peristalsis. In many invertebrates, muscles are composed of unstriped muscle cells similar to those of vertebrate unstriped muscle. ↓ SMOOTH MUSCLE · MUSCLE CELL ↑ MUSCULAR TISSUE → AUTONOMIC NERVOUS SYSTEM · PERISTALSIS

CP051 smooth muscle (*n.*) Alternative term for UNSTRIPED MUSCLE. ↓ UNSTRIATED MUSCLE · INVOLUNTARY MUSCLE ↑ UNSTRIPED MUSCLE

CP052 unstriated muscle (*n.*) Alternative term for UNSTRIPED MUSCLE. ↑ SMOOTH MUSCLE

CP053 involuntary muscle (*n.*) Alternative term for UNSTRIPED MUSCLE. ↑ SMOOTH MUSCLE → INVOLUNTARY ACTION

CP054 muscle cell (*n.*) A uninucleated, spindle-shaped cell with tapering ends; it is capable of slow sustained contractions along the longitudinal axis of the cell. A single contraction can take up to 15 seconds. The cell cytoplasm is called sarcoplasm and contains unstriated myofibrils arranged parallel to each other and to the longitudinal axis of the cell ↑ UNSTRIPED MUSCLE → MYOFIBRILS

CP055 cardiac muscle (*n.*) (In vertebrates) a tissue consisting of anastomosing striated muscle fibres; it is found only in the muscular wall of the heart. The muscle fibres are similar in structure to those of striped muscle but do not possess a sarcolemma. Cardiac muscle is capable of automatic rhythmical contraction and is under the control of the pacemaker. ↓ INTERCALATED DISCS ↑ MUSCULAR TISSUE → PACEMAKER

CP056 intercalated discs (*n.pl.*) Bands extending partially or wholly across the fibres of cardiac muscle. They are presumed to be cell boundaries. ↑ CARDIAC MUSCLE

Nervous Tissue

CQ001 nervous tissue (*n.*) Nervous tissue consists of nerve cells and their fibres or of nerve fibres alone, together with accessory cells surrounding the cells or fibres, and connective tissues with blood-vessels. ↓ NEURAL TISSUE · NERVE CELL · NERVE · NEURON THEORY → TISSUE · IRRITABILITY

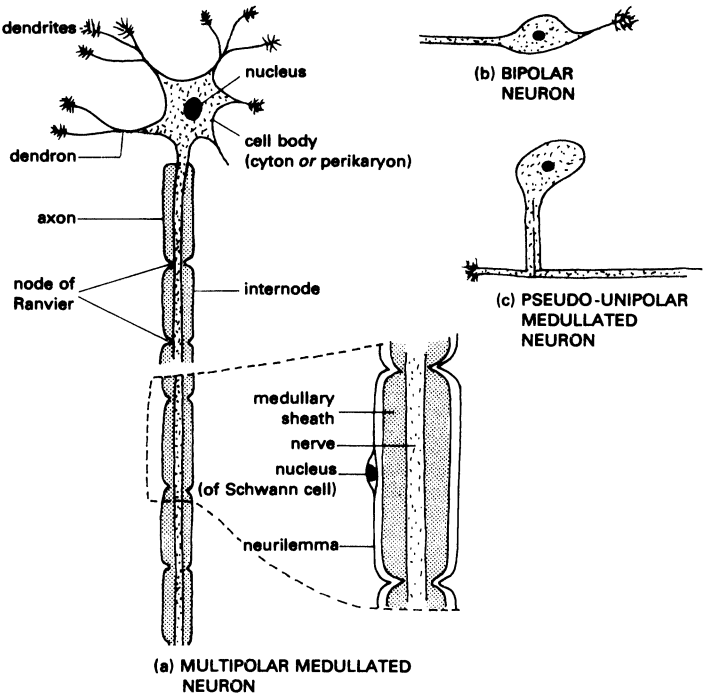
CQ002 neural tissue (*n.*) Embryonic nervous tissue, in vertebrates consisting of columnar epithelial cells; it later develops into neurons and neuroglia. ↓ NEUROGLIA · GLIA ↑ NERVOUS TISSUE

CQ003 neuroglia (*n.*) A tissue mainly composed of a network of protoplasmic and long fibrous branching processes of cells; it provides support for nerve cell bodies and nerve fibres, especially in the brain and spinal cord. ↑ NEURAL TISSUE

CQ004 glia (*n.*) Alternative name for NEUROGLIA.

CQ005 nerve cell (*n.*) **1** A uninucleated cell, with cytoplasm containing fibrils, and with long thread-like processes arising from the cell body. The cell body is also known as a perikaryon or cyton. A process is either an axon or a dendron. Such cells are found in all coelomates. Nerve cell is usually taken to exclude the processes, but the term is sometimes used instead of neuron. **2** In coelenterates, a nerve cell is polygonal with the points drawn out into five processes which form many small branches at their ends; the processes are not separable into axons and dendrons; the term neuron cannot be used for these cells. ↓ NEURON · NERVE FIBRIL · AXON · MULTIPOLAR ↑ NERVOUS TISSUE

CQ006 neuron (*n.*) A nerve cell with its processes of axon and dendrons. The majority of neurons have one axon and several dendrons. Neurons are in contact with one another through synapses. The neuron is the basic element of the nervous system of any metazoan. Neurons are



described as **unipolar, bipolar,** or **multipolar**. ↓ NEURONE · NEUROBLAST ↑ NERVE CELL

CQ007 neurone (*n.*) Alternative spelling for NEURON.

CQ008 neuroblast (*n.*) A type of epithelial cell from which neurons develop. ↑ NEURON

CQ009 nerve fibril (*n.*) A thin, thread-like structure forming part of a network of fibrils in the cytoplasm of nerve cells, and forming part of a group of parallel fibrils in the protoplasm of nerve fibres. ↓ NEUROFIBRIL ↑ NERVE CELL → NERVE FIBRE

CQ010 neurofibril (*n.*) Alternative term for NERVE FIBRIL.

CQ011 axon (*n.*) A process, usually long, arising from the cell body of a neuron; it conducts nerve impulses *away from* the cell body. A neuron usually has one long axon, which branches only at its termination. An axon terminates at a synapse with an effector or with another neuron. ↓ DENDRON · DENDRITE · PERIKARYON · TELENEURITE · TELODENDRION · CYTON · AXON TERMINAL · NEUROCYTON ↑ NERVE CELL → IMPULSE

CQ012 dendron (*n.*) A process, usually short, arising from the cell body of a neuron; it conducts nerve impulses *towards* the cell body. A neuron may have numerous dendrons. A dendron has branches along its entire length; these branches divide into many smaller branches (dendrites). Dendrons terminate at synapses with other neurons. ↑ AXON

CQ013 dendrite (*n.*) One of the fine branches at the termination of a dendron. If a dendron is very short it is composed almost entirely of dendrites. The term dendrite is sometimes used in place of the term dendron. ↑ AXON

CQ014 perikaryon (*n.*) The cell body of a neuron; the term excludes cell processes, *i.e.* axons and dendrons. ↑ AXON

CQ015 teleneurite (*n.*) A terminal arborization of an axon (the equivalent of a dendrite on a dendron). ↑ AXON

CQ016 telodendrion (*n.*) Alternative term for TELENEURITE.

CQ017 cyton (*n.*) The cell-body of a neuron. ↑ AXON · PERIKARYON (Sn)

CQ018 axon terminal (*n.*) Alternative term for TELENEURITE.

CQ019 neurocyton (*n.*) Alternative term for CYTON.

CQ020 multipolar (*adj.*) Describes a neuron with numerous processes, *i.e.* one axon and several dendrons. ↓ BIPOLAR · UNIPOLAR ↑ NERVE CELL

CQ021 bipolar (*n.*) Describes a neuron with two processes, an axon and a dendron. ↑ MULTIPOLAR

CQ022 unipolar (*adj.*) **1** Describes a

modification of a bipolar neuron in which a single process leaves the nerve cell body and splits into an axon and a dendron; also ***pseudo-unipolar.*** **2** Describes a neuron with one process, such as is found in invertebrates and the lower vertebrates. ↑ MULTIPOLAR

CQ023 nerve (*n.*) A bundle of parallel funiculi with associated connective tissue and blood vessels, enclosed in a sheath of connective tissue which forms a tough external coat, called the epineurium. —NERVOUS, ***innervated*** (*adj.*) ↓ NERVE FIBRE · MEDULLARY SHEATH · NERVOUS · MEDULLATED ↑ NERVOUS TISSUE

CQ024 nerve fibre (*n.*) An axon of a neuron. The fibre may be covered with a sheath of myelin (medullated) or not (non-medullated). The diameter of nerve fibres in vertebrates varies from 1 to 20 μm; the length can be as long as that of an animal, *e.g.* 2 m and over. In some invertebrates, *e.g.* the earthworm, fibres of 1 mm diameter occur. The distal end of a nerve fibre usually has numerous small branches. ↓ FUNICULUS[2] · PERINEURIUM · ENDONEURIUM · EPINEURIUM · NEURILEMMA · NEUROLEMMA ↑ NERVE → GIANT NERVE FIBRE

CQ025 funiculus[2] (*n.,pl.* **funiculi**) A bundle of parallel nerve fibres surrounded by a sheath of connective tissue, the perineurium. The fibres are held together and supported in the funiculus by fine connective tissue, the endoneurium. The funiculus also contains neuroglia. —***funiculate*** (*adj.*) ↑ NERVE FIBRE

CQ026 perineurium (*n.*) See FUNICULUS[2](↑).

CQ027 endoneurium (*n.*) See FUNICULUS[2] (↑).

CQ028 epineurium (*n.*) See NERVE(↑).

CQ029 neurilemma (*n.*) **1** A thin, elastic, outer sheath surrounding a medullary sheath on medullated nerve fibres. A neurilemma consists of nucleated cells (Schwann's cells). **2** A very thin outer coat surrounding a non-medullated nerve fibre. —***neurilemmal*** (*adj.*) ↑ NERVE FIBRE

CQ030 neurolemma (*n.*) Alternative term for NEURILEMMA.

CQ031 medullary sheath (*n.*) A sheath of myelin investing a nerve fibre; it acts as an insulator for the nerve fibre. It is covered by a thin outer sheath (neurilemma) of connective tissue. The medullary sheath is not continuous, but is interrupted by nodes of Ranvier □ *the medullary sheath invests a nerve fibre; a nerve fibre is covered by a medullary sheath* ↓ NODE OF RANVIER · RANVIER'S NODE · INTERNODE[1] · SCHWANN CELL · MYELIN · MYELIN SHEATH ↑ NERVE

CQ032 node of Ranvier (*n.*) A constriction, regularly repeated along a medullated nerve, where the medullary sheath is interrupted; the neurilemma is narrowed and no myelin is present at the node. Lymph nourishes the nerve at a node. ↑ MEDULLARY SHEATH

CQ033 Ranvier's node (*n.*) Alternative term for NODE OF RANVIER.

CQ034 internode[1] (*n.*) The region of a nerve fibre between two nodes of Ranvier, which is invested in a myelin sheath. ↑ MEDULLARY SHEATH

CQ035 Schwann cell (*n.*) A long, thin, uninucleated cell forming part of the neurilemma, enclosing a medullary sheath; there is one cell between two successive nodes of Ranvier. ↑ MEDULLARY SHEATH

CQ036 myelin (*n.*) A soft, white, fatty substance containing protein, which forms a sheath round most nerve fibres in vertebrates and crustaceans. —***myelination*** (*n.*) ***myeloid*** (*adj.*) ↑ MEDULLARY SHEATH

CQ037 myelin sheath (*n.*) Alternative term for MEDULLARY SHEATH.

CQ038 nervous (*adj.*) **1** Of or to do with nerves, *e.g.* the nervous system is the network of nerves and associated structures in the body of an animal. **2** Caused by nerves, *e.g.* a nervous impulse is the means by which information is conveyed by the nerves. ↓ NEURAL · NEUROID · NEUROTROPIC · NEUROTROPHIC ↑ NERVE

CQ039 neural (*adj.*) Of or to do with the structure of nerves, or structures associated with nerves, *e.g.* ***a*** the neural canal of the backbone (enclosing the spinal cord); ***b*** a neural arc forming the connection between receptor and effector. ↑ NERVOUS

CQ040 neuroid (*adj.*) Nerve-like; describes the intercellular and intracellular conduction of stimuli by non-nervous tissue, as in Protozoa when cilia beat rhythmically by neuroid stimulation. ↑ NERVOUS

CQ041 neurotropic (*adj.*) Attracted to nervous tissue, *e.g.* toxins causing paralysis in tetanus, bacteria, and other pathogens, such as the rabies virus, some dyes and stains, are all neurotropic. —***neurotropism*** (*n.*) ↑ NERVOUS

CQ042 neurotrophic (*adj.*) Describes substances nourishing the nervous system. ↑ NERVOUS

CQ043 medullated (*adj.*) Describes a nerve fibre covered by a medullary sheath. Medullated nerves consist of medullated nerve fibres; they rarely branch, except at their distal termination. ↓ MYELINATED · NON-MEDULLATED · NON-MYELINATED ↑ NERVE · MYELIN · MEDULLARY SHEATH

CQ044 myelinated (*adj.*) Alternative term for MEDULLATED.

CQ045 non-medullated (*adj.*) Describes a nerve fibre surrounded only by a neurilemma; there is no medullary sheath. Large nuclei are situated along the length of the nerve fibre. Non-medullated nerves consist of non-medullated nerve fibres; such nerves frequently form branches. ↑ MEDULLATED

CQ046 non-myelinated (*adj.*) Alternative term for NON-MEDULLATED.

CQ047 neuron theory (*n.*) The theory that the nervous system is made up of numerous discrete neurons, which appear to be able to act independently, but always act in close association with other neurons by making contact through synapses. Each neuron

originates from a single cell in embryonic neural tissue. ↓ ALL-OR-NONE LAW · SYNAPSE · SYNAPTIC ↑ NERVOUS TISSUE · NEURON

CQ048 all-or-none law (*n.*) A statement concerning the reaction of neurons and muscle fibres. A stimulus of any intensity produces only two possible reactions: a response of invariable strength, or no response; there is no partial response, with the exception that rapidly repeated stimuli cause a stronger contraction of muscle fibre. ↑ NEURON THEORY

CQ49 synapse (*n.*) The point at which the tip of a terminal branch of an axon from one neuron touches the perikaryon (cell body) of another neuron, or interdigitates without touching with the tips of dendrites from another neuron. An axon usually enters into several synapses, each synapse providing a connection with a different neuron. Each dendron and perikaryon enters into several synapses, each synapse connecting with the axon of a different neuron. The perikaryon (cell body) of a neuron in a large vertebrate may connect with several hundred synapses. A nerve impulse on reaching a synapse has to stimulate a connected neuron, if any further effect is to be produced. Impulses are transmitted through synapses in one direction only, from axon to dendron or perikaryon. Most synapses are located in the central nervous system of animals possessing such a system □ *synapses transmit nerve impulses* —SYNAPTIC (*adj.*) ↓ IMPULSE[1] · RESTING POTENTIAL · ACTION POTENTIAL · NEUROTRANSMITTER · ACETYLCHOLINE · REGENERATION[2] ↑ NEURON THEORY

CQ050 impulse[1] (*n.*) A signal conducted along a nerve fibre. It is a travelling wave of electrical disturbance arising from changes in ionic concentrations across the surface membrane of the nerve fibre. The wave moves along the membrane surface at a speed of 1 to 100 m/s, depending on, ***a*** the species of animal; ***b*** the diameter of the fibre—the larger the diameter, the greater the speed; ***c*** the presence or absence of a medullary sheath; ***d*** the temperature. A medullary sheath increases the speed of the wave, at least 50 times, as the impulses apparently jump from node to node. The energy of the impulse is provided locally along the fibre membrane, so there is no loss of vigour; the impulse is initiated by a stimulus, but each impulse is thereafter independent of the original stimulus. Each impulse occupies about 5 cm of length on a nerve fibre. After the impulse has passed a point on the fibre, a few milliseconds must elapse before the fibre can conduct again (refractory period). Most stimuli initiate a succession of impulses. Different stimuli, produce differing frequencies of impulses, but each impulse is unaffected by the intensity of the stimulus (the all-or-none law). The maximum frequency of impulses depends on the refractory period when the nerve fibre cannot conduct. An impulse travels without loss of energy through a neuron □ *a nerve fibre conducts an impulse; an impulse is transmitted through a synapse* ↑ SYNAPSE

CQ051 resting potential (*n.*) When a nerve fibre is not conducting an impulse, the inside of the fibre is electrically negative to the outside. ↑ SYNAPSE

CQ052 action potential (*n.*) A localized change in electric potential between the inside and outside of a nerve fibre which takes place when an impulse passes along the nerve fibre; it marks the position of the impulse. During the change, the outside of the nerve fibre is electrically negative to the inside. ↑ SYNAPSE

CQ053 neurotransmitter (*n.*) A chemical substance which transmits nervous impulses across a synapse from one neuron to another neuron. ↑ SYNAPSE

CQ054 acetylcholine (*n.*) A substance found in almost all animals with a peripheral nervous system; it is produced at the nerve endings of cholinergic nerve fibres, both at effectors and at synapses. Its function is to relay impulses from one nerve to another nerve, or to a muscle. It is destroyed almost immediately by cholinesterase. Acetylcholine is a neurotransmitter. ↑ SYNAPSE

CQ055 regeneration[2] (*n.*) The growth of a nerve after it has been cut; regeneration takes place from the end connected to the nerve cell body. The distal part of the nerve, from the cut onwards, degenerates. The growth of the nerve fibres is guided by the neurilemma from the cut end to the effector. Only medullated nerves are capable of regeneration. —***regenerative*** (*adj.*) REGENERATE (*v.*) ↑ SYNAPSE

CQ056 synaptic (*adj.*) Of or to do with synapses □ *nerve fibres of one neuron are in synaptic connection with nerve fibres of other neurons* ↓ REFRACTORY[2] ↑ NEURON THEORY

CQ057 refractory[2] (*adj.*) **1** Describes the state of a nerve fibre when it cannot conduct an impulse; this occurs immediately after an impulse has passed. The refractory state lasts a few milliseconds. **2** Not reacting to stimuli. ↑ SYNAPTIC · IMPULSE[1]

Blood Tissue

CR001 blood (*n.*) A fluid tissue contained in a network of vessels or sinuses in an animal. The vessels or sinuses are lined with endothelium. Blood is circulated round the network by muscular action of the vessels or by one or more hearts. It transports oxygen,

metabolites and hormones; it contains soluble colloidal proteins and blood corpuscles; it assists in temperature control of mammals. —***bloody*** (*adj.*) ↓ BLOOD CORPUSCLE · PLASMA (H) · RED BLOOD CELL · WHITE BLOOD CELL · PLATELETS · HAEMORRHAGE → TISSUE · CLOT · COAGULATE[2]

CR002 blood corpuscle (*n.*) One of the various types of cell that circulate in blood plasma; also called ***blood cell.*** They are more abundant and of a greater variety in mammals than in other animals. ↓ HAEMATOBLAST · HAEMATOCYTE · RED BLOOD CELL · WHITE BLOOD CELL ↑ BLOOD

CR003 haematoblast (*n.*) A cell that will develop into an erythrocyte, a thrombocyte or a blood platelet. ↑ BLOOD CORPUSCLE

CR004 haematocyte (*n.*) A blood corpuscle, or cell, found in arthropods. Some act as phagocytes; some with hyaline cytoplasm effect coagulation of the plasma and develop thread-like processes to form a clot. ↑ BLOOD CORPUSCLE → THROMBOCYTE · CLOT

CR005 plasma (*n.*) The clear, water-like, colourless liquid of blood and other body liquids; blood plasma is formed by removing all blood corpuscles from blood. Plasma can be clotted. —***plasmic*** (*adj.*) ↓ LYMPH · SEROTHERPY · SEROUS ↑ BLOOD

CR006 lymph (*n.*) An alkaline colourless liquid obtained from blood by filtration through capillary walls. It contains a smaller amount of soluble blood proteins and white blood cells than blood, but more lymphocytes; it contains no red blood cells. It is found in vertebrates. —LYMPHATIC (*n.*) LYMPHOID, LYMPHATIC (*adj.*) ↓ TISSUE FLUID · SERUM[1] ↑ PLASMA

CR007 tissue fluid (*n.*) The fluid which bathes cells in an animal body. The fluid diffuses through the walls of blood capillaries, takes dissolved oxygen and food substances to the cells, removes excretory products from the cells and passes into the lymphatic system. It is also referred to (incorrectly) as ***lymph.*** Tissue fluid receives lymphocytes in lymph glands and the greater concentration of lymphocytes gives rise to lymph. The distinction between tissue fluid and lymph is not always made. ↑ LYMPH

CR008 serum[1] (*n.,pl.* **sera**) **1** A watery liquid found in animals; blood serum is a yellowish liquid which separates from blood when blood clots; it is almost the same as plasma without the clotting constituents. **2** A liquid containing antibodies or antitoxins, injected into a person to give passive acquired immunity. —SEROUS (*adj.*) SEROLOGY, SEROTHERAPY (*n.*) ↑ LYMPH

CR009 serotherapy (*n.*) The use of sera in curing and preventing disease. ↓ SEROLOGY ↑ PLASMA

CR010 serology (*n.*) The study of antigen-antibody reactions ↑ SEROTHERAPY → ANTIBODY

CR011 serous (*adj.*) Of or to do with the production of serum; the term describes, ***a*** any of the liquids found in hollows of the bodies of animals; ***b*** any membrane lining coelomic spaces. ↓ LYMPHATIC[1] · LYMPHOID ↑ PLASMA → SEROUS MEMBRANE[1]

CR012 lymphatic[1] (*adj.*) Of, to do with, or conducting lymph. ↑ SEROUS → LYMPHATIC SYSTEM

CR013 lymphoid (*adj.*) Describes a tissue containing or producing lymph cells. ↑ SEROUS → LYMPHOID TISSUE

CR014 red blood cell (RBC) (*n.*) A flattened, disc-shaped cell, which circulates in vertebrate blood. It contains a respiratory pigment, haemoglobin. In most mammals, RBCs are round; in other vertebrates they are oval. The cell is readily distorted, elastic, and immotile. Mammalian RBCs have no nuclei, but the RBCs of mammalian embryos and of other vertebrates have nuclei. RBCs are formed in red bone marrow, are destroyed by erythrophages, have a relatively short life (average 120 days in man). Human RBCs are circular biconcave discs, about 8 μm in diameter, there are approximately five million per mm^3 in normal blood. ↓ ERYTHROCYTE · HAEMOGLOBIN · HAEM[2] · HAEMOLYTIC ↑ BLOOD

CR015 erythrocyte (*n.*) Alternative term for RED BLOOD CELL.

CR016 reticulocyte (*n.*) An immature red blood cell, which has a reticular appearance when stained. ↑ ERYTHROCYTE

CR017 erythroblast (*n.*) A nucleated cell which develops into a red blood cell. ↑ ERYTHROCYTE

CR018 erythrophage (*n.*) A type of white blood cell such as a macrophage or a monocyte, which destroys red blood cells. ↑ ERYTHROCYTE → MONOCYTE

CR019 haemopoiesis (*n.*) The formation of red blood cells and leucocytes, occurring in the red bone marrow of vertebrates. ↑ ERYTHROCYTE → LEUCOCYTE

CR020 haemolysis (*n.*) The destruction of red blood cells through lysis, *i.e.* by rupture of the cell membrane. —HAEMOLYSIN (*n.*) HAEMOLYTIC (*adj.*) ***haemolyse*** (*v.*) ↑ ERYTHROCYTE → LYSIS (Sn)

CR021 haemolysin (*n.*) Any substance that can act as an agent of haemolysis; usually formed as an antibody in blood in reaction to invasion by pathogens. ↑ ERYTHROCYTE

CR022 megaloblast (*n.*) A large, rudimentary cell which develops into an erythroblast. In some forms of anaemia, megaloblasts are found in the blood, when they appear as very large spherical red blood cells. —***megaloblastic*** (*adj.*) ↑ ERYTHROCYTE

CR023 normoblast (*n.*) An immature red blood cell, still possessing a nucleus, developed from an erythroblast. It loses its nucleus and develops into a red blood cell. ↑ ERYTHROCYTE

CR024 rouleaux (*n.pl.*) Aggregations of red blood cells which look like a pile of coins. ↑ ERYTHROCYTE

CR025 haemoglobin (*n.*) A red iron-containing respiratory pigment found in the

blood of vertebrates and some invertebrates. It consists of haem combined with globin, a blood protein. Each animal species has a different variety of haemoglobin, differing in molecular weight, oxygen-combining properties, etc. It is chemically related to chlorophyll, cytochrome, haemocyanin and myoglobin. ↓ HAEMOCYANIN · MYOGLOBIN · CYTOCHROME · ERYTHROCRUORIN · CHLOROCRUORIN ↑ RED BLOOD CELL → CHLOROPHYLL

CR026 haemocyanin (*n.*) A blue, copper-containing, respiratory pigment found in the blood of molluscs, crustaceans and other arthropods. ↑ HAEMOGLOBIN

CR027 myoglobin (*n.*) A variety of haemoglobin found in voluntary muscle fibres; it has a higher affinity for oxygen than haemoglobin, and thus assists in the transfer of oxygen to muscles. ↑ HAEMOGLOBIN

CR028 cytochrome (*n.*) A mixture of iron-containing proteins taking part, mainly as co-enzymes, in cellular respiration; it is found abundantly in aerobic organisms. It is oxidized by dissolved oxygen in a cell, and reduced by oxidizable substances in the cell. It is the main vehicle for the use of oxygen in metabolism. ↑ HAEMOGLOBIN → AEROBIC · METABOLISM

CR029 erythrocruorin (*n.*) A red, respiratory pigment, containing iron; it is found in some invertebrates. ↑ HAEMOGLOBIN

CR030 chlorocruorin (*n.*) A green, iron-containing, respiratory pigment found in the blood of some Polychaeta. ↑ HAEMOGLOBIN

CR031 haem² (*n.*) An iron-containing substance. On oxidation, haematin is formed. Haem is the basic unit of the haemoglobin molecule. Primitive vertebrates have one haem molecule in a molecule of haemoglobin; mammals have four haem molecules in their haemoglobin. ↓ HAEMATIN ↑ RED BLOOD CELL

CR032 haematin (*n.*) A substance containing iron and having the property of readily dissociating from oxygen. ↑ HAEM²

CR033 haemolytic (*adj.*) Describes an agent or a process of haemolysis. ↓ HAEMAL ↑ RED BLOOD CELL · HAEMOLYSIS

CR034 haemal (*adj.*) **1** Of or to do with blood or blood vessels. **2** Situated on the vertebral column on the same side as the heart. ↑ HAEMOLYTIC

CR035 white blood cell (WBC) (*n.*) A nucleated, motile, colourless cell found in the blood and lymph of animals; it contains no respiratory pigments. In vertebrates, it is either a lymphocyte, a polymorph, or a monocyte. In man, there are approximately 8,000 WBCs per mm^3 of blood. ↓ LEUCOCYTE · POLYMORPH · LYMPHOCYTE · PHAGOCYTE · MACROPHAGE · PHAGOCYTIC ↑ BLOOD · MOTILE

CR036 leucocyte (*n.*) Alternative term for WHITE BLOOD CELL. ↓ POLYMORPH · MYELOID TISSUE · LEUCOPOIESIS · MYELOCYTE · MYELOBLAST · LYMPHOID TISSUE · POLYMORPHONUCLEAR LEUCOCYTE ↑ WHITE BLOOD CELL

CR037 polymorph (*n.*) A polynucleated, irregularly shaped, white blood cell, exhibiting amoeboid movement. The nucleus consists of two or more lobes joined by threads. In some vertebrates, the nucleus does not possess lobes; in man, the nucleus can consist of up to five lobes, the number of lobes increasing with the age of the cell. In a healthy person, the distribution of polymorphs by the number of lobes remains constant; any variation indicates a diseased condition. The cells are all active phagocytes. They are produced continually in bone marrow and constitute about 70% of all leucocytes in man. The cytoplasm of polymorphs in man is granular in nature; some granulations stain with acid dyes (eosinophils), some with basic dyes (basophils), and some with neutral dyes (neutrophils). All three types increase in number during infection. —***polymorphic*** (*adj.*) ↑ LEUCOCYTE

CR038 myeloid tissue (*n.*) (In vertebrates) tissue producing erythrocytes and polymorphs continually; it is located in bone marrow. ↑ LEUCOCYTE → MARROW

CR039 leucopoiesis (*n.*) The formation of white blood cells in myeloid or lymphoid tissues. ↑ LEUCOCYTE

CR040 myelocyte (*n.*) Marrow cells in the long bones of vertebrates; they are possibly the precursors of leucocytes. ↑ LEUCOCYTE → MARROW

CR041 myeloblast (*n.*) A cell in bone marrow (myeloid tissue) from which myelocytes develop. ↑ LEUCOCYTE

CR042 lymphoid tissue (*n.*) A tissue of vertebrates; it produces lymphocytes by division of some cells. It occurs in lymph glands, which are formed from a network of reticulin fibres enclosing lymphocytes, lymphoblasts, and macrophages. It also occurs in the spleen, tonsils, and thymus. ↑ LEUCOCYTE → LYMPHOID ORGAN · LYMPH NODE · LYMPH GLAND · LYMPH FOLLICLE · SPLEEN · THYMUS · TONSILS

CR043 polymorphonuclear leucocyte (*n.*) Alternative term for POLYMORPH (↑).

CR044 lymphocyte (*n.*) A spherical white blood cell with one large nucleus and relatively little cytoplasm. Two types exist, small and large lymphocytes; they are produced continually in lymphoid tissues, such as lymph nodes, by cell division. The cells are non-phagocytic, exhibit amoeboid movement, and produce antibodies in the blood. They constitute about 25% of all leucocytes in human blood. —***lymphocytosis*** (*n.*) ↓ MONOCYTE · LYMPHOBLAST · MONOBLAST · RETICULAR CELLS ↑ WHITE BLOOD CELL

CR045 monocyte (*n.*) A spherical white blood cell with an oval nucleus; it is the largest of the white blood cells. The cells are voraciously phagocytic and exhibit amoeboid movement. They are produced in

lymphoid tissues, and constitute about 5% of all leucocytes in man. ↑ LYMPHOCYTE → MACROPHAGE

CR046 lymphoblast (*n.*) A cell in lymphoid tissue; lymphocytes develop from it. ↑ LYMPHOCYTE · LYMPHOID TISSUE

CR047 monoblast (*n.*) A cell in lymphoid tissue; monocytes develop from it. ↑ LYMPHOCYTE

CR048 reticular cells (*n.pl.*) Cells occurring in bone-marrow, spleen, and lymph glands; they form lymphocytes and monocytes, *i.e.* white blood cells. ↑ LYMPHOCYTE

CR049 phagocyte (*n.*) A white blood cell which engulfs foreign bodies, particularly pathogens, by enclosing the body in cytoplasm through a process of extending pseudopodia round it (the amoeboid movement for engulfing.) In mammals, polymorphs, monocytes and macrophages are phagocytes. Macrophages can be phagocytes of other WBCs. Phagocytes are an important part of the defence mechanism of most animals against invading pathogens. —PHAGOCYTISM (*n.*) PHAGOCYTIC (*adj.*) ↓ PHAGOCYTOSIS · PHAGOCYTISM · PHAGOLYSIS · PHAGOCYTOLYSIS ↑ WHITE BLOOD CELL

CR050 phagocytosis (*n.*) The action of ingestion by engulfing, and digestion of foreign bodies (especially pathogenic micro-organisms), by phagocytes. ↑ PHAGOCYTE

CR051 phagocytism (*n.*) The disposition of a white blood cell to act as a phagocyte. ↑ PHAGOCYTE

CR052 phagolysis (*n.*) The destruction of phagocytes. ↑ PHAGOCYTE

CR053 phagocytolysis (*n.*) Alternative term for PHAGOLYSIS. ↑ PHAGOCYTE

CR054 macrophage (*n.*) A large phagocytic cell with one nucleus, occurring in vertebrates; movement is by membrane-like pseudopodia. These cells are found in contact with blood and with lymph, at the sites of corpuscle formation, *e.g.* in bone marrow, lymph nodes, spleen, etc. Their function is to remove foreign particles from blood and lymph. Macrophages are also found in all loose connective tissue, but they only become active when the tissue is damaged. Their function is to remove the debris from damaged tissues; they form the reticulo-endothelial system in vertebrates. In the inactive state, *i.e.* in undamaged tissue, the resting form of the cell is called a histiocyte. Macrophages are closely related to monocytes. ↓ HISTIOCYTE · HISTIOBLAST ↑ WHITE BLOOD CELL → MONOCYTE

CR055 histiocyte (*n.*) A large cell with one nucleus found in loose connective tissue. It is inactive, but becomes an active macrophage when the tissue is damaged ↑ MACROPHAGE

CR056 histioblast (*n.*) A cell in connective tissue which develops into a histiocyte. ↑ MACROPHAGE

CR057 phagocytic (*adj.*) **1** Of or to do with phagocytes. **2** Exhibiting, or having the ability to exhibit, phagocytosis. ↓ PHAGOCYTABLE ↑ WHITE BLOOD CELL

CR058 phagocytable (*adj.*) Describes pathogens which can be ingested by phagocytes. ↑ PHAGOCYTIC

CR059 platelets (*n.pl.*) Very small, non-nucleated, round or oval discs, which are fragments of cells from red bone marrow, found only in mammalian blood. There are approximately 200 000-400 000 per mm^3 in human blood. They initiate blood clotting, by disintegrating and liberating thrombokinase. ↓ THROMBOCYTE · THROMBOKINASE · CLOT · COAGULATE[2] ↑ BLOOD

CR060 thrombocyte (*n.*) A small, spindle-shaped, nucleated cell, occurring abundantly in the blood of non-mammalian vertebrates. The cell readily disintegrates, liberating thrombokinase and initiating blood clotting. ↓ HAEMOCYTE · CLOT ↑ PLATELETS

CR061 haemocyte (*n.*) A blood corpuscle, or cell, found in arthropods. Some act as phagocytes, some with hyaline cytoplasm; they effect coagulation of the plasma and develop thread-like processes, to form a clot. ↑ THROMBOCYTE

CR062 thrombokinase (*n.*) A factor, or kinase, which converts prothrombin into thrombin in the presence of calcium ions. It is liberated from blood platelets, thrombocytes or injured tissues. ↓ THROMBOPLASTIN · PROTHROMBIN · THROMBIN · FIBRINOGEN · FIBRIN · THROMBOGEN · CLOT ↑ PLATELETS

CR063 thromboplastin (*n.*) Alternative term for THROMBOKINASE.

CR064 prothrombin (*n.*) A soluble blood protein, which is a zymogen, converted to thrombin by thrombokinase. ↑ THROMBOKINASE

CR065 thrombin (*n.*) An enzyme which converts fibrinogen (a soluble blood protein) to fibrin (an insoluble protein) during blood clotting. ↑ THROMBOKINASE

CR066 fibrinogen (*n.*) See THROMBIN. ↑ THROMBOKINASE

CR067 fibrin (*n.*) An insoluble protein forming fibrous threads which mesh together in a network and produce a clot of blood. It is formed from fibrinogen. ↑ THROMBOKINASE

CR068 thrombogen (*n.*) Alternative term for PROTHROMBIN (↑).

CR069 clot (*n.*) **1** A solid mass produced from or in a liquid by coagulation. **2** A blood clot. In vertebrates, fibrinogen (a soluble blood protein) is converted to insoluble fibres of fibrin by an enzyme, thrombin. Thrombin is formed from a soluble blood protein, prothrombin, by thrombokinase. Thrombokinase is liberated by damaged tissues, or by blood platelets, or by thrombocytes. The fibres of fibrin form a network trapping blood corpuscles and forming a clot. The clot prevents blood escaping from injured blood vessels. In some arthropods, haemocytes form thread-like processes and coagulate plasma. —***clot*** (*v.*) ***clotted*** (*adj.*) ***clotting*** (*n.*) ↓ THROMBUS (Sn) · INFARCTION · INFARCT · THROMBOKINESIS · EMBOLUS

· COAGULATE[2] · THROMBOSIS ↑ PLATELETS

CR070 thrombus (*n.*) A clot or small mass of solidified blood formed in a blood vessel or in the heart. —***thrombosis*** (*n.*) ↑ CLOT

CR071 infarction (*n.*) **1** A clot of blood, or other obstruction, which prevents blood flowing in a blood vessel, and so stops the blood supply to part of an organ of the body. **2** The formation of an infarct. —INFARCT (*n.*) ***infarct*** (*v.*) ↑ CLOT

CR072 infarct (*n.*) The part of an organ suffering from an infarction. Because the blood supply is cut off, the infarct dies. * CLOT

CR073 thrombokinesis (*n.*) The cascade of processes from initiation to the final formation of a blood clot. ↑ CLOT

CR074 embolus (*n.*) **1** A small, semi-solid clot of blood, capable of transport by the blood stream. **2** Any foreign blody, such as an air-bubble, which is able to be transported in a similar way. ↑ CLOT

CR075 coagulate[2] (*v.i.*) (Of part or all of a liquid) to become jelly-like, or solid, because of chemical action, *e.g.* ***a*** blood coagulates and forms a clot; ***b*** egg white coagulates when heated. —COAGULATION (*n.*) ***coagulated*** (*adj.*) ↓ CONGEAL ↑ PLATELETS

CR076 congeal (*v.i.*) (Of a liquid) to become jelly-like, or solid, because of freezing or drying up. —***congelation*** (*n.*) ↑ COAGULATE[2]

CR077 haemorrhage (*n.*) The loss of blood from injured blood vessels. —***haemorrhagic*** (*adj.*) ↓ HAEMOPHILIA · THROMBOSIS · ANAEMIA · ALBUMINOSIS ↑ BLOOD

CR078 haemophilia (*n.*) A sex-linked, hereditary disease in which the ability to clot blood is absent. It occurs in males, is inherited from females, but is very rarely manifested in females. —HAEMOPHILIAC (*n.*) ***haemophilic*** (*adj.*) ↓ HAEMOPHILIAC * HAEMORRHAGE

CR079 haemophiliac (*n.*) A person suffering from haemophilia. ↑ HAEMOPHILIA

CR080 thrombosis (*n.*) The formation of a thrombus. If the thrombus is carried to the heart, or is formed in the blood vessels of the heart, it may cause death. If it is formed in the blood vessels of the brain, it may cause paralysis. ↓ PHLEBITIS · EMBOLISM · APOPLEXY ↑ HAEMORRHAGE · CLOT · THROMBUS

CR081 phlebitis (*n.*) Inflammation of the wall of a vein; a thrombus is produced inside the vein. ↑ THROMBOSIS

CR082 embolism (*n.*) The blocking of a blood vessel by an embolus. ↑ THROMBOSIS · EMBOLUS

CR083 apoplexy (*n.*) A period of unconsciousness, more or less prolonged, arising either from the formation of a thrombus in the blood vessels of the brain, or from the rupture of an artery supplying the brain. On recovery to consciousness, paralysis of part of the body may occur. ↑ THROMBOSIS → PARALYSIS

CR084 anaemia (*n.*) A disease in which the blood has, ***a*** insufficient red blood cells, or ***b*** red blood cells with insufficient haemoglobin, or ***c*** megaloblasts which are present in place of normal RBCs. In all cases, the blood has a lower capacity for the transport of oxygen, and thus starves the tissues of oxygen; this results in weakness and a reduced ability to fight disease. Haemorrhage in sufficient quantity can also cause anaemia. —***anaemic*** (*adj.*) ↓ LEUKAEMIA · LEUCOCYTOSIS · MEGALOBLASTIC ANAEMIA · PERNICIOUS ANAEMIA ↑ HAEMORRHAGE

CR085 leukaemia (*n.*) A disease in which the number of white blood cells in the blood is persistently and greatly increased. Anaemia develops and the spleen is enlarged. Different types of leukaemia are caused by an excess of different types of WBCs. Myeloblasts and myelocytes are also usually present in addition to the increased numbers of WBCs. The disease may cause death. ↑ ANAEMIA

CR086 leucocytosis (*n.*) A condition in which the number of white blood cells in the blood is increased beyond the normal limits. It indicates a response to tissue damage or to invasion by pathogens. ↑ ANAEMIA

CR087 megaloblastic anaemia (*n.*) The type of anaemia in which megaloblasts are formed due to a deficiency of cobalamin. The efficiency of megaloblasts as oxygen carriers is very low. ↑ ANAEMIA → MEGALOBLAST · COBALAMIN

CR088 pernicious anaemia (*n.*) Alternative term for MEGALOBLASTIC ANAEMIA.

CR089 albuminosis (*n.*) A condition in which the concentration of albumin in the blood is too high. ↑ HAEMORRHAGE → ALBUMIN · ALBUMINURIA

Plant Tissue

CS001 cellulose (*n.*) A long-chain polysaccharide, the principal structural compound in plants, and the fundamental constituent of cell-walls in algae, some fungi and the higher plants. Its molecules are formed by the condensation of many glucose molecules. The cellulose molecules form micelles containing approximately 200 molecules. Cellulose micelles and free cellulose molecules form a network with pectin filling in the reticulation. Cellulose fibres are formed by the association of micelles into long strands, called microfibrils, and the microfibrils in bundles form fibres;

these fibres form the fibres of cotton, linen, etc., used in textiles. ↓ PECTIC COMPOUNDS · RESIN · PECTOSE · RAPHIDE · LIGNIFICATION · RESINOUS · MUCILAGINOUS · HYDATHODE · MERISTEM · PERMANENT PLANT TISSUES · SCLERENCHYMA · EPIDERMIS[1] · ENDODERMIS → TISSUE · MICELLE

CS002 pectic compounds (*n.pl*) Acid polysaccharide carbohydrates, including pectic acid, pectates, pectose and pectin; they form gels with pectic enzymes and occur in cell-walls when unlignified. ↓ PECTIN · LIGNIN · SUBERIN · MUCILAGE · CUTIN ↑ CELLULOSE → PECTOSE

CS003 pectin (*n.*) A group of white, non-crystalline carbohydrates present in the cell-walls before cellulose is deposited on the wall. The nature of pectin is not clearly defined; pectose, an insoluble form of pectic acid, forms the chief substance of walls of young cells. Insoluble pectose is converted by pectase into a soluble pectin when fruits ripen; this forms vegetable jelly. ↑ PECTIC COMPOUNDS

CS004 lignin (*n.*) A complex, aromatic organic compound; it is deposited in the cellulose cell-wall of sclerenchyma, tracheids, and xylem vessels; it greatly stiffens the cell-wall, making it rigid. The function of lignification is mechanical, the same function as bone tissue in vertebrates. Between one-quarter and one-third of the wood in a tree is lignin. —***lignification*** (*n.*) ***lignified, unlignified*** (*adj.*) ***lignify*** (*v.*) ↑ PECTIC COMPOUNDS ↓ SCLERENCHYMA

CS005 suberin (*n.*) A mixture of products of fatty acids, formed by oxidation and condensation, resulting in a fatty substance which is impervious to water. It occurs in the stems and roots of many plants; in the walls of cork cells, it is protective in function. —***suberized*** (*adj.*) ↑ PECTIC COMPOUNDS

CS006 mucilage (*n.*) A thick, jelly-like material of varying composition; it is hard when dry and swells and becomes slimy when made moist. It is produced in the cell walls of many plants, and covers the surface of the cells. —***mucilaginous*** (*adj.*) ↑ PECTIC COMPOUNDS → MUCUS

CS007 cutin (*n.*) A wax-like substance which is a complex mixture of oxidation and condensation products of fatty acids; it is formed in the cuticle of plants. —***cutinized*** (*adj.*) ↑ PECTIC COMPOUNDS → CUTICLE[1]

CS008 resin (*n.*) An acidic organic substance secreted by certain plants and trees, particularly by conifers; it is either a vitreous solid, or occurs in solution with an essential oil in a balsam. It becomes a sticky liquid on heating, and is soluble in ethanol. Some resins are composed of polymerized carboxylic acids mixed with oxidation products of terpenes, other are derivatives of phenol. There are a number of different resins, produced by different species of plants. —RESINOUS (*adj.*) ↓ LATEX · ESSENTIAL OIL[1] · GUM[1] · CALLOSE · MANNA · MANNITOL · INULIN · HEMICELLULOSE ↑ CELLULOSE

CS009 latex (*n.,pl.* **latices**) A milky, clear, or sometimes coloured, liquid, which exudes from the cut surface of certain flowering plants; it coagulates rapidly on exposure to air. It is contained in special branching tubes. The function of latex is not completely understood; it is thought to be concerned in the protection and healing of superficial wounds, and also in nutrition. Latex contains many different substances including sugars, proteins, mineral salts, alkaloids and caoutchouc. Caoutchouc is found in latex from the rubber tree, and the coagulated and smoked latex forms commercial rubber; it is the most important latex product. —LATICIFEROUS (*adj.*) ↑ RESIN → LATEX VESSELS

CS010 essential oil[1] (*n.*) A volatile oil, with a distinctive odour, contained in plant organs. Essential oils give flowers their odour, and fruit their flavour. The oil can be obtained by distillation from plant tissues and is used in the manufacture of perfumes. ↑ RESIN

CS011 gum[1] (*n.*) Any one of a group of colloidal substances, usually polysaccharides, exuded by certain plants. A gum is sticky when liquid, but hard when dry and solid · it is a form of vegetable mucilage. ↑ RESIN

CS012 callose (*n.*) A hard white carbohydrate which occurs in a callus in plants. ↑ RESIN → CALLUS[1]

CS013 manna (*n.*) A sweet sticky exudation from certain trees. ↑ RESIN

CS014 mannitol (*n.*) A solid alcohol derived from a sugar, usually mannose. forming the main constituent of manna. It is also an important storage product of brown algae. ↑ RESIN

CS015 inulin (*n.*) A soluble polysaccharide. composed of fructose molecules; it occurs as food storage material in some plants, *e.g.* the dahlia, but does not occur in animals. ↑ RESIN

CS016 hemicelluose (*n.*) One of several long-chain polysaccharides, chemically dissimilar to cellulose in that the carbon chains are shorter and often branched, and it is a polymer formed from monosaccharide residues other than glucose; it occurs in cell walls of cotyledons, endosperms, and woody tissues; it sometimes functions as a food reserve, especially in seeds. ↑ RESIN

CS017 pectose (*n.*) A pectic compound converted to pectin and cellulose by the enzyme pectosinase. ↓ PECTATES ↑ CELLULOSE

CS018 pectates (*n.pl*) Salts of pectic acid formed with mineral ions *e.g.* calcium pectate. ↑ PECTOSE

CS019 raphide (*n.*) A needle-shaped crystal of calcium oxalate; bundles of such crystals occur in some plants and may be excretory products. ↓ CYSTOLITH ↑ CELLULOSE

CS020 cystolith (*n.*) An ingrowth of the cell-wall of an epidermal cell; it contains a deposit of calcium carbonate, excreted by the plant; it occurs in such plants as the stinging nettle. ↑ RAPHIDE

CS021 lignification (*n.*) The process of depositing lignin in the cell walls of sclerenchyma, xylem vessels and tracheids. ↓ SUBERIZATION ↑ CELLULOSE · LIGNIN

CS022 suberization (*n.*) The process of depositing suberin in the walls of cork cells. ↑ LIGNIFICATION · SUBERIN

CS023 resinous (*adj.*) Of or to do with resin, or like resin; the term is used to describe odours. ↓ LATICIFEROUS ↑ CELLULOSE

CS024 laticiferous (*adj.*) Describes tissues and vessels conducting latex, or cells secreting latex. ↑ RESINOUS

CS025 mucilaginous (*adj.*) **1** Containing or consisting of mucilage. **2** Like mucilage. ↑ CELLULOSE → MUCUS

CS026 hydathode (*n.*) A gland occurring on the tips or edges of the leaves of many plants; it secretes water, especially when the humidity is too high to allow much evaporation; water pressure in the xylem vessels rises because of osmotic absorption in the roots. ↓ RESIN CANALS · SCHIZOGENOUS ↑ CELLULOSE → GUTTATION

CS027 resin canals (*n.pl.*) Ducts in mesophyll, bark or wood; they are lined with glandular epithelium which secretes essential oils, such as terpenes; oxidation products of terpenes, with polymerized carboxylic acids, form resins. The canals are formed schizogenously in plant tissues. ↓LATEX VESSELS · LYSIGENOUS CAVITY · COENOCYTE[2] · LATICIFERS · SCHIZOGENOUS ↑ HYDATHODE

CS028 latex vessels (*n.pl.*) Ducts or tubes which conduct, or which store, latex. The vessels ramify through plant tissues, forming a network. One type of vessel develops from a single cell and elongates without forming cross-walls. The cell walls are composed of cellulose and the cell contains a single nucleus. A second type of vessel, called a coenocyte, develops from several cells, whose walls break down. A coenocyte has many nuclei. ↑ RESIN CANALS → LATEX

CS029 lysigenous cavity (*n.*) A cavity formed when a cell disintegrates; the cavity is normally filled with secretions produced by the cell, *e.g.* oil glands in the leaves of citrus trees contain lysigenous cavities. ↑ RESIN CANALS

CS030 coenocyte[2] (*n.*) See LATEX VESSELS. —***coenocytic*** (*adj.*) ↑ RESIN CANALS

CS031 laticifers (*n.pl.*) Alternative term for LATEX VESSELS (↑).

CS032 schizogenous (*adj.*) Describes the formation of secretory cavities in plants when the cavity is made by the separation of cells. —SCHIZOGENESIS (*n.*) ↓ LYSIGENOUS ↑ HYDATHODE

CS033 lysigenous (*adj.*) Describes the formation of secretory cavities in plants when the cavity is made by the destruction or dissolution of secreting cells. ↑ SCHIZOGENOUS

CS034 meristem (*n.*) (In plants) a tissue formed of cells capable of undergoing active cell-division; it is found at the growing points. New cells formed in meristem are capable of diversification; they give rise to characteristic permanent tissues, *e.g.* epidermis, vascular tissue and endodermis. The principal meristems in flowering plants are found at the tips of stems and roots, in young leaves, at the bases of internodes, and in cambium and cork cambium.—***meristematic*** (*adj.*) ↓ MERISTEMATIC CELLS · APICAL MERISTEM · TUNICA[2] · HISTOGEN · HISTOGENETIC ↑ CELLULOSE → PARENCHYMA[1]

CS035 meristematic cells (*n.pl.*) Small plant cells in a state of active cell-division. A characteristic cell has 14 sides, fits closely with neighbouring cells and has only a thin cell-wall which is composed of a mixture of pectin and protein; the cell has a dense granular protoplasm with no vacuoles. ↓ PRIMARY MERISTEM · SECONDARY MERISTEM ↑ MERISTEM → PARENCHYMATOUS CELLS · PROSENCHYMATOUS CELLS · STONE CELL

CS036 primary meristem (*n.*) Meristem that has existed as such since the embryo formed in the seed, or since the plant grew from the seed, *e.g.* meristem at the tips of roots and stems. It is also called a ***apical meristem.*** ↑ MERISTEMATIC CELLS

CS037 secondary meristem (*n.*) Meristem that develops from parenchymatous tissues, *e.g.* tissues in secondary thickening and the formation of bark, tissues that form in response to a superficial wound. ↑ MERISTEMATIC CELLS → CAMBIUM

CS038 apical meristem (*n.*) A growing point at the tip of a stem or root; it is a zone of cell division. In seed plants its origin is a group of cells (initial cell); in ferns its origin is a single initial cell. Apical meristem consists of a promeristem and a zone of elongation. In stems, the zone of elongation is divided into two distinct regions, the tunica and the corpus. In roots, the zone of elongation is divided into four histogens: plerome, dermatogen, calyptrogen, and periblem. The cells in the zone of elongation continue to divide; they also elongate and start to form vacuoles. In the zone, elaboration of tissues starts, and at the end of the zone, differentiation into primary permanent tissues has taken place. Apical meristem provides for the lengthening of the axis of stem and root; it is also, in stems, the site of origin of the primordia of leaves and buds, but in roots it only provides for lengthening. ↓ PROMERISTEM · PRIMORDIAL MERISTEM · PRIMARY APICAL MERISTEM · INITIAL CELLS ↑ MERISTEM

CS039 promeristem (*n.*) The tissue at the extreme tip of apical meristem; it contains actively dividing cells which have not yet shown signs of differentiation into morphological tissues. The promeristem is a few millimetres long. In stems, the promeristem consists of two observable regions, the tunica and the corpus. In roots there are two types of promeristem. In the first type there is only one group of meristematic cells; in the second type there are four groups of cells in distinct layers, and the

groups give rise to four histogens: calyptrogen, dermatogen, plerome and periblem. —***promeristematic*** (*adj.*) ↓ TUNICA[2] · HISTOGEN ↑ APICAL MERISTEM

CS040 primordial meristem (*n.*) Alternative term for PROMERISTEM (↑).

CS041 primary apical meristem (*n.*) The distinct layers of cells observable in the zone of elongation of apical meristem. ↑ APICAL MERISTEM

CS042 initial cells (*n.pl.*) A group of cells forming the promeristem. ↑ APICAL MERISTEM

CS043 tunica[2] (*n.*) (In the apical meristem of shoots or stems) a zone of tissue consisting of one or several peripheral layers of cells. The cells of tunica exhibit surface growth; they are regular and oblong in longitudinal section, have no vacuoles, and become hexagonal in transverse section owing to pressure; cell division is perpendicular to the surface. No fixed relation exists between the tunica and the primary permanent tissues, except for epidermis which arises from the outermost tunica layer; other tissues may originate from the tunica, or from the corpus, or from both. ↓ CORPUS ↑ MERISTEM

CS044 corpus (*n.,pl.* **corpora**) A zone of tissue enclosed by the tunica. Cells of corpus increase by volume growth, develop vacuoles, and are irregular in shape and arrangement. The planes of cell division are very irregular. The vascular cylinder and pith usually arise from the corpus, possibly with other primary tissues, depending on the plant species. ↑ TUNICA[2]

CS045 histogen (*n.*) A distinct zone of tissue observable in an apical meristem of flowering plants. Four histogens are recognised in apical meristem; plerome, periblem, dermatogen and calyptrogen. In a histogen, the cells continue to divide, but also start to differentiate, *i.e.* to form primary permanent tissues. Each histogen is part of a primary apical meristem, and is found in a zone of elongation. —HISTOGENESIS (*n.*) HISTOGENETIC (*adj.*) ↓ PERIBLEM · DERMATOGEN · PLEROME · CALYPTROGEN · PROTODERM · HISTOGENESIS ↑ MERISTEM

CS046 periblem (*n.*) The layers of ground tissue between the plerome and the dermatogen; it gives rise to the cortex of the mature plant. ↑ HISTOGEN

CS047 dermatogen (*n.*) The outer part of apical meristem; it is the embryonic epidermis and gives rise to the epidermis of the mature plant. ↑ HISTOGEN

CS048 plerome (*n.*) The central part of apical meristem; it gives rise to the pith and the vascular cylinder of the mature plant. ↑ HISTOGEN

CS049 calyptrogen (*n.*) (In many plants) a layer of actively dividing cells covering the apex of the growing root; it gives rise to the root-cap. ↑ HISTOGEN → ROOT CAP

CS050 protoderm (*n.*) Alternative term for DERMATOGEN (↑).

CS051 histogenesis (*n.*) The formation and differentiation of tissues, started in plants from histogens. ↑ HISTOGEN

CS052 histogenetic (*adj.*) Describes structures producing tissues, *e.g.* ***a*** the apical meristematic layers of cells in a plant are histogenetic; ***b*** cambium is histogenetic. ↑ MERISTEM → CAMBIUM

CS053 permanent plant tissues (*n.pl.*) (In plants) tissues consisting of cells which are fully differentiated with diverse characteristics according to the tissue; these cells do not divide and undergo little change until they lose their protoplasm and die. Permanent tissues described by function include epidermis, endodermis and vascular tissue. Permanent tissue, described by cell development and structure, are parenchyma or prosenchyma. ↓ PARENCHYMA[1] · PROSENCHYMA · MESOPHYLL · PARENCHYMAL ↑ CELLULOSE

CS054 parenchyma[1] (*n.*) (In plants) a tissue, generally soft, formed of living, thin-walled cells, which are usually round-ended, and almost as broad as they are long. Between the cells is a system of intercellular spaces containing air. The tissues may vary in structure and function, as in pith, cortex, and mesophyll, all of which are typically composed of parenchyma. Parenchyma and prosenchyma are the two chief permanent tissues of plants. —PARENCHYMAL, PARENCHYMATOUS (*adj.*) ↓ PARENCHYMATOUS CELLS · COLLENCHYMA[1] · AERENCHYMA · OEDEMA[2] ↑ PERMANENT PLANT TISSUES

CS055 parenchymatous cells (*n.pl.*) Isodiametric, large plant cells, generally appearing hexagonal in shape (owing to the pressure of neighbouring cells) with thin cell-walls composed of cellulose. There are small triangular intercellular spaces at the angles of the cells. The cytoplasm forms a layer lining the cell-wall; inside the cytoplasm is a large vacuole containing cell sap. The cell has a nucleus either in the protoplasmic lining, or is supported by protoplasmic threads in the vacuole. The cell is mature and does not undergo cell-division. ↑ PARENCHYMA[1] · MERISTEMATIC CELLS

CS056 collenchyma[1] (*n.*) In young, actively growing plants, parenchymatous cells become strengthened by the thickening of the cell-walls with cellulose; this forms collenchyma. Collenchyma gives mechanical support to plant structures such as stems, leaves, and petioles, but is uncommon in roots. Thickening of the cell-wall takes place, ***a*** only at the cell corners; the living cells are still capable of extension; ***b*** all round the cell, leaving no intercellular spaces; ***c*** all round the cell, but particularly at the corners, so that intercellular spaces are left. Collenchyma commonly occurs in the cortex of herbaceous stems and along the veins of leaves. ↑ PARENCHYMA[1]

CS057 aerenchyma (*n.*) A plant tissue consisting of thin-walled cells with large intercellular spaces which are filled with air; the intercellular spaces may occupy up to 50% of the tissue. It occurs in the roots,

stems and leaves of some aquatic plants. Its function is the same as that of parenchyma. ↑ PARENCHYMA[1]

CS058 oedema[2] (*n.*) A large abnormal accumulation of parenchyma. ↑ PARENCHYMA[1]

CS059 prosenchyma (*n.*) A plant tissue consisting of elongated, spindle-shaped cells, with pointed ends; the cells fit closely together; they often have the cell-walls thickened, and usually lose all protoplasm. Prosenchyma occurs in mechanical and vascular tissues; it is one of the two chief permanent tissues in plants. —***prosenchymatous*** (*adj.*) ↓ PROSENCHYMATOUS CELLS ↑ PERMANENT PLANT TISSUES

CS060 prosenchymatous cells (*n.pl.*) Large plant cells, resembling parenchymatous cells in all characteristics, except that they are elongated longitudinally. Each cell is spindle-shaped and tapers to a point, so that the cells fit accurately together, and provide strong but flexible mechanical support. The cell-walls are often thickened by lignification. ↑ PROSENCHYMA

CS061 mesophyll (*n.*) The internal parenchyma of a leaf; it is differentiated into palisade, mesophyll and spongy mesophyll, and is bounded by the upper and lower epidermis of the leaf. ↓ SPONGY MESOPHYLL · PALISADE MESOPHYLL · GROUND TISSUE[2] ↑ PERMANENT PLANT TISSUES

CS062 spongy mesophyll (*n.*) Mesophyll consisting of irregularly shaped cells, loosely arranged with large air spaces between the cells. The tissue is located above the lower epidermis of a leaf. The air spaces communicate with the atmosphere through stomata in the lower epidermis of the leaf. The cells contain fewer chloroplasts than palisade cells; their primary function is gaseous exchange through stomata in photosynthesis and respiration. ↑ MESOPHYLL → STOMA

CS063 palisade mesophyll (*n.*) Mesophyll consisting of slightly elongated cells arranged perpendicularly to a leaf surface, in two or three layers of cells, with small intercellular spaces. The tissue is located immediately below the upper epidermis of the leaf. The cells contain numerous chloroplasts, and have an important function in photosynthesis. ↑ MESOPHYLL → CHLOROPLASTS

CS064 ground tissue[2] (*n.*) A plant tissue composed mainly of thin-walled parenchyma; the cell-walls may be thickened in some forms. Ground tissue includes pith, cortex, medullary rays and hypodermis. ↑ MESOPHYLL → VASCULAR TISSUE · TRACHEID · ENDODERMIS · EPIDERMIS[1]

CS065 parenchymal (*adj.*) Describes a tissue with the characteristics of parenchyma, *e.g.* plant cortex is a parenchymal tissue. The term describes the development and arrangement of the cells rather than the function of the tissue. ↓ PARENCHYMATOUS ↑ PERMANENT PLANT TISSUES

CS066 parenchymatous (*adj.*) Describes an organism or part of an organism with a parenchyma, *e.g.* ***a*** the internal structure of leaves is parenchymatous; ***b*** the internal structure of platyhelminths is parenchymatous. **2** Describes the cells that make up parenchyma. ↑ PARENCHYMAL

CS067 sclerenchyma (*n.*) Thick-walled plant tissue in which the cell-walls are lignified and inelastic; it provides strong mechanical support for plants. The thickening of the cell-wall leaves a very small lumen in the cell; at maturity, the cell contains no protoplasm. —***sclerenchymatous*** (*adj.*) ↓ SCLEROTIC PARENCHYMA · STONE CELL · TRABECULAE · TRABECULAR ↑ CELLULOSE

CS068 sclerotic parenchyma (*n.*) Alternative term for SCLERENCHYMA. ↓ SCLERENCHYMATOUS PROSENCHYMA ↑ SCLERENCHYMA

CS069 sclerenchymatous prosenchyma (*n.*) A plant tissue developed from prosenchyma; the cell-walls become thickened by deposits of lignin and are inelastic. It provides mechanical support for a plant, especially in stems. ↑ SCLEROTIC PARENCHYMA ↓ FIBRES[1]

CS070 stone cell (*n.*) A plant cell with thickened, lignified walls; a type of cell found in sclerenchyma. The cell is slightly longer than it is broad, and occurs either singly or in groups of cells. It occurs amongst other cells in leaves, fruits, and seed coats, to give mechanical support to the surrounding tissues. ↓ SCLEREID · TRACHEID · FIBRES[1] · STEREID ↑ SCLERENCHYMA

CS071 sclereid (*n.*) Any type of plant cell in sclerenchyma other than a fibre, it occurs in a variety of forms, including stone cells. ↑ STONE CELL

CS072 tracheid (*n.*) A long, narrow, non-living plant cell, forming a tube with closed tapering ends; it occurs in xylem. The cell-wall is thickened with lignin and is pitted. Each tracheid is in communication with the organ in which it lies, and with other tracheids, by means of the pits. Its function is to conduct water and solutions; in vascular plants other than flowering plants, it is the only type of conducting and mechanical cell. It corresponds to a vessel in a flowering plant. —***tracheidal*** (*adj.*) ↑ STONE CELL · GROUND TISSUE[2] → XYLEM

CS073 fibres[1] (*n.pl.*) Extremely long and narrow plant cells occurring in sclerenchymatous prosenchyma and in sclerenchyma. Fibres either occur singly or are grouped into strands. They can withstand great mechanical strain, *e.g.* ***a*** flax (cellulose fibres); ***b*** cotton (cellulose fibres); ***c*** hemp (lignified fibres). —***fibrous*** (*adj.*) ↑ STONE CELL · SCLERENCHYMATOUS PROSENCHYMA

CS074 stereid (*n.*) Alternative term for STONE CELL (↑).

CS075 trabeculae (*n.pl., sing.* **trabecula**) Rod-like cells or a row of cells forming supporting structures lying across spaces or lumina in plants and animals, *e.g.* ***a*** outgrowths of the cell wall across the lumen of tracheids; ***b*** membranes from the inner wall of a sporangium crossing the interior; ***c*** the

supporting meshwork in spongy bone. —TRABECULAR, ***trabiculate*** (*adj.*) ↑ SCLERENCHYMA

CS076 trabecular (*adj.*) Of or to do with trabeculae. ↓ TRABECULATE ↑ SCLERENCHYMA

CS077 trabeculate (*adj.*) Possessing trabeculae; the term describes a structure with supporting trabeculae, *e.g.* tracheids in plants can be trabeculate. ↑ TRABECULAR

CS078 epidermis[1] (*n.*) (In plants) the outer layer of tissue, one cell thick. Aerial epidermis is covered with a protective cuticle. —***epidermal*** (*adj.*) ↓ CUTICLE[1] · CORK ↑ CELLULOSE

CS079 cuticle[1] (*n.*) A layer of non-cellular material covering the aerial epidermis of a plant; it is secreted by the epidermis and is composed of cutin. It forms a continuous layer broken only by stomata and lenticels. Its chief function is to protect against excessive water loss, but it also provides protection against mechanical injury. —CUTICULARIZATION (*n.*) ***cuticular*** (*adj.*) ↓ CUTINIZATION · CUTICULARIZATION[1] · BARK · CALLUS[1] · PILIFEROUS LAYER · VELAMEN ↑ EPIDERMIS[1] → CUTIN

CS080 cutinization (*n.*) The formation of cutin in cell-walls or on epidermal surfaces. ↑ CUTICLE[1]

CS081 cuticularization[1] (*n.*) The formation of a cuticle on an epidermis. ↑ CUTICLE[1]

CS082 bark (*n.*) A protective tissue of dead cells found on the outside of the older stems and roots of woody plants. Beneath the visible bark is a layer of cork. As the tree expands in girth, the outer cells of the cork layer are put under a strain; this causes the dead tissues to split and causes the fissured appearance of some barks. The bark flakes off from time to time so that the layers of cork and outer bark remain of comparable thickness □ *the bark is rough; some bark is smooth; bark contains dead cells* ↑ CUTICLE[1]

CS083 callus[1] (*n.*) A tissue that forms over a wound or cut on the surface of woody plants. It is usually formed by the cambium to protect the injured surface. ↑ CUTICLE[1] → CALLOSE

CS084 piliferous layer (*n.*) The region of the root epidermis which bears root hairs; it extends backwards from the apical meristem, the distance depending on the plant species. ↑ CUTICLE[1] → ROOT HAIR

CS085 velamen (*n.*) A spongy tissue occurring on the outside of the aerial roots of some epiphytes such as orchids. It consists of a layer of dead cells, usually with walls spirally thickened and perforated; its function is to absorb rain water, the tissue acting as a sponge; the root then absorbs this water. ↑ CUTICLE[1]

CS086 cork (*n.*) A protective tissue of dead cells formed on the periphery of woody plants. The cell-walls are impregnated with suberin, making them impervious to water, and the cells themselves are empty, containing only air. Cork also occurs under scale-leaf scars, and at the site of wounds on the surface of the plant. Cork is formed by cork-cambium, or phellogen, and it replaces the epidermis of young stems and roots. Certain trees, *e.g.* the cork oak (*Quercus suber*), develop cork abundantly and build up a considerable thickness of the substance; such cork is stripped from the tree for commercial use □ *the cork lies under the bark; cork contains dead cells* ↓ CORK-CAMBIUM · PHELLOGEN · PHELLEM ↑ EPIDERMIS[1]

CS087 cork-cambium (*n.*) See CORK.

CS088 phellogen (*n.*) Alternative term for CORK-CAMBIUM.

CS089 phellem (*n.*) Alternative term for CORK (↑).

CS090 endodermis (*n.*) A single layer of cells, the innermost layer of the cortex; it surrounds the pericycle. It occurs in all roots and in the stems of ferns and of some dicotyledons. It consists of rectangular, closely-fitting cells, characterized by a Casparian strip in younger cells; in older cells the cell-wall becomes impregnated with suberin, cellulose, or lignin, making the cell impervious to water. The function of the endodermis is to control the transfer of water and sap between the cortex and the vascular cylinder, via passage cells. —***endodermal*** (*n.*) ↓ CASPARIAN STRIP · CAMBIUM ↑ CELLULOSE → PERICYCLE

CS091 Casparian strip (*n.*) A strip on the cell-wall of endodermal cells; it is impregnated with suberin and lignin. The strip runs right round the cell-wall, and may be as narrow as a thread, or as wide as the wall. The strip is impervious to water. Its function is to control the flow of water between the cortex and the vascular cylinder. ↓ PASSAGE CELLS ↑ ENDODERMIS

CS092 passage cells (*n.pl.*) In the roots of monocotyledons, the endodermal cells become thickened with deposits of cellulose, suberin, and lignin, and thus impervious to water. Opposite the protoxylem group in the stele, a passage cell in the endodermis remains unthickened to allow the passage of water and sap between the cortex and the vascular cylinder. ↑ CASPARIAN STRIP

CS093 cambium (*n.*) A meristem tissue containing actively dividing cells. Vascular, or fascicular cambium occurs between xylem and phloem in the vascular tissue of most dicotyledons, and forms secondary phloem and secondary xylem by secondary thickening. It does not occur in monocotyledons. In plants with vascular bundles the cambium between the bundles is called interfascicular cambium, and it completes the ring of cambium. ↑ ENDODERMIS

Cytology

CT001 cytology (*n.*) The study of the structure, behaviour and function of cells of animals, plants and bacteria. —***cytological*** (*adj.*) ***cytologist*** (*n.*) ↓ CYCLOSIS · DIFFERENTIATION[1] · LIPOID[1] · CELLULAR · LIPOID[2] → CELL · CELL DIVISION · DIVISION OF LABOUR · TISSUE

CT002 cyclosis (*n.*) The circulation of protoplasm in a cell, described as **streaming**. ↓ PINOCYTOSIS · EMEIOCYTOSIS · CYTOLYSIS · CYTOLYSIN ↑ CYTOLOGY

CT003 pinocytosis (*n.*) The method by which liquid surrounding a cell is ingested; a local invagination of the plasma-membrane encloses a minute drop of liquid which is then engulfed by the cytoplasm to form a vesicle. It is an important method for ingesting substances of high molecular weight. ↑ CYCLOSIS

CT004 emeiocytosis (*n.*) The process in which a local evagination of the plasma-membrane removes a minute drop of liquid from a vesicle in the cytoplasm. Liquid is egested by emeiocytosis and the process is thought to be responsible for the secretion of proteins by cells. ↑ CYCLOSIS

CT005 cytolysis (*n.*) The destruction or dissolution of a cell, usually effected by the destruction of the cell membrane. ↑ CYCLOSIS → LYSIS

CT006 cytolysin (*n.*) Any substance which causes cytolysis, *e.g.* phenol (carbolic acid). ↑ CYCLOSIS

CT007 differentiation[1] (*n.*) The modification that takes place in cells resulting in a change in the structure and function of the cell, and hence, when many cells are modified, a modification in the tissue composed of the cells, *e.g.* meristematic cells show no differences in function, but when they develop into permanent tissues, they undergo differentiation and become changed in structure, and altered in function, so that the tissues composed of the differentiated cells are organized for the division of labour in the mature plant. —***differentiated*** (*adj.*) ***differentiate*** (*v.*) ↓ SPECIALIZATION[1] ↑ CYTOLOGY → DIVISION OF LABOUR

CT008 specialization[1] (*n.*) Differentiation in cells produces cells with a structure and function suited to a special purpose; the end result of differentiation is specialization *e.g.* ***a*** muscle cells, specialized for sudden and strong contraction of protoplasm; ***b*** nerve cells, specialized for the conduction of impulses; ***c*** glandular epithelial cells, specialized for secretion. ↑ DIFFERENTIATION[1] → SPECIALIZATION[2]

CT090 lipoid[1] (*n.*) **1** A fat-like substance, soluble in the same solvents as fats, but with no fatty acids in the molecule. **2** A fat-like substance, containing fatty acids, but not a true fat as it is not an ester of glycerol; it is soluble in the same solvents as fats. ↓ LIPOID-PROTEIN ↑ CYTOLOGY → FAT[1] · FATTY ACID

CT010 lipoid-protein (*n.*) A substance consisting of protein combined with fatty compounds; lipoid-proteins occur in the plasma-membranes of cells. ↑ LIPOID[1]

CT011 cellular (*adj.*) **1** Of or to do with cells. **2** Consisting of cells. ↓ INTRACELLULAR · EXTRACELLULAR · INTERCELLULAR · CYTOLOGICAL ↑ CYTOLOGY

CT012 intracellular (*adj.*) Describes a process occurring, or a substance found, inside a cell, *e.g.* ***a*** intracellular enzymes are found, and act, inside a cell, ***b*** intracellular digestion takes place within a cell. ↑ CELLULAR

CT013 extracellular (*adj.*) Describes a process occurring, or a substance found, outside a cell, *e.g.* ***a*** extracellular enzymes are produced by a cell and are found outside it; ***b*** extracellular digestion takes place outside a cell. ↑ CELLULAR

CT014 intercellular (*adj.*) Between or among cells, *e.g.* ***a*** sinusoids passing between liver cells are intercellular; ***b*** the matrix surrounding bone cells is an intercellular material; ***c*** tissue fluid bathing cells is an intercellular liquid. ↑ CELLULAR

CT015 cytological (*adj.*) Of or to do with cytology, *i.e.* mainly with the functions and life-history of cells. ↑ CELLULAR

CT016 lipoid[2] (*adj.*) Describes a substance resembling a fat because it is fat-soluble, not a true fat. ↑ CYTOLOGY

CT017 cell (*n.*) An individual unit of protoplasm surrounded by a plasma-membrane and usually containing a nucleus; in plants, a cell wall surrounds the plasma membrane. A cell may exhibit all the characteristics of a living organism, or it may be highly specialized for a particular function. Cells vary considerably in size and shape, but all have the common features of metabolism. Every living organism is composed of cells, and every cell is formed from existing cells, usually by division, but also by fusion of sex cells. A cell may contain more than one nucleus. In prokaryotic cells, the genetic material is not contained in a nucleus. In plants, the unit of protoplasm is called a protoplast; the cell wall together with its protoplast are known as a plant cell. —***cellular*** (*adj.*) ↓ PROTOPLASM · NUCLEUS[1] · PLASMA-MEMBRANE · VACUOLE · NUCLEOLUS · PROTOPLASMIC · NUCLEAR[2] · VACUOLAR · ORGANELLE · PLASTID · MICROSOME ↑ CYTOLOGY → PROKARYOTIC

CT018 protoplasm (*n.*) The jelly-like granular material which comprises the living content of cells; it is a complex mixture of organic and inorganic substances in a state of continuous chemical change. The main constituent is water. Numerous proteins, lipids, and inorganic salts are dissolved, dispersed, or suspended in the water. The composition of protoplasm varies from one species to another, from

cells of one function to cells of another function, and even from one individual to another individual of the same species. The system of enzymes responsible for controlling metabolism, and the nucleic acid systems for the synthesis of enzymes are both situated in the protoplasm. Vacuoles, secretions, and ingested material in cells are not considered to be part of the protoplasm. In plants and animals, protoplasm is differentiated into cytoplasm and nucleus in eukaryotic cells —***protoplasmic*** (*adj.*) ↓ CYTOPLASM · PROTOPLAST · ENDOPLASM · ECTOPLASM · PLASMA-MEMBRANE · ECTOPLAST ↑ CELL

CT019 cytoplasm (*n.*) All the protoplasm of a cell outside, and surrounding, the nucleus. The cytoplasm is not just a simple, slightly viscous, fluid; in it are situated various structures, called organelles, each concerned with different functions of the cell. The plasma-membrane is part of the cytoplasm. —***cytoplasmic*** (*adj.*) ↓ ENDOPLASM (H) · ECTOPLASM (H) · NUCLEOPLASM ↑ PROTOPLASM → ORGANELLE

CT020 protoplast (*n.*) (In plants) the living unit of protoplasm, consisting of one nucleus and the remaining protoplasm with its system of enzymes. A plant cell consists of a protoplast and the surrounding cell wall. A protoplast in botany is equivalent to a cell in zoology (both have a plasma-membrane). ↑ PROTOPLASM

CT021 endoplasm (*n.*) **1** (In animals) the inner layer of cytoplasm in many cells. It differs from ectoplasm in having greater fluidity, and containing many more granules. It is sometimes called ***plasmasol***. **2** (In plants) the cytoplasm inside the plasma-membrane. ↑ PROTOPLASM

CT022 ectoplasm (*n.*) **1** (In animals) the outer layer of cytoplasm in many cells. It differs from the inner layer (endoplasm) in being semi-solid, and is especially important in cell division and amoeboid movement. It is generally clear and contains relatively few granules. If solid enough, the ectoplasm is usually a gel, and is called ***plasmagel***. The two regions of ectoplasm and endoplasm have no distinct boundary, but gradually merge into each other. **2** (In plants) ectoplasm is the plasma-membrane, also called ***ectoplast***. ↑ PROTOPLASM

CT023 nucleus[1] (*n.,pl.* **nuclei**) A spherical or ovoid body, present in almost all living cells of animals and plants, but absent in bacteria and blue-green algae. The nucleus is bounded by a fine membrane; it contains a liquid, sap, in which one or more nucleoli are observed, and an irregular reticulation when stained with basic dyes. The reticulation may be an artefact, although chromosomes become visible when a cell is about to divide. The nucleus of a cell is derived from a mother cell by mitosis, or by meiosis, or sometimes by amitosis; it contains the structures controlling the reproduction and functioning of the cell; these are DNA contained in chromosomes. The nucleus is essential to the cell for it to continue living; without it, the cytoplasm soon dies. A cell may contain more than one nucleus. —***nuclear, nucleate*** (*adj.*) ↓ NUCLEOPLASM · KARYOPLASM · NUCLEAR MEMBRANE · NUCLEAR SAP · NUCLEI ↑ CELL → MACRONUCLEUS · MICRONUCLEUS · POLYMORPH · DNA · CHROMOSOME

CT024 nucleoplasm (*n.*) The protoplasm in the nucleus of a cell; it is much denser than cytoplasm and contains nucleoproteins. —***nucleoplasmic*** (*adj.*) ↑ NUCLEUS[1]

CT025 karyoplasm (*n.*) Alternative term for NUCLEOPLASM.

CT026 nuclear membrane (*n.*) A delicate membrane surrounding the nucleus. Minute pores in the nuclear membrane allow exchange of materials between nucleus and cytoplasm. ↑ NUCLEUS[1]

CT027 nuclear sap (*n.*) The liquid ground substance of the nucleus; it contains one or more nucleoli and chromatin threads. Nuclear sap is very viscous, and in some cases, semi-solid. Nuclear sap is also a synonym for nucleoplasm. ↓ NUCLEOLUS · CHROMATIN ↑ NUCLEUS[1]

CT028 nuclei (*n.pl.*) Plural of NUCLEUS[1] (↑).

CT029 plasma-membrane (*n.*) A very thin membrane (about 10 nm thick) surrounding the cytoplasm of a cell. It consists of fat molecules and protein molecules. The membrane controls, by its permeability, the penetration of substances from the environment into the cytoplasm and vice-versa. If the plasma-membrane is ruptured or otherwise damaged the cell is destroyed by leakage of its contents. In plants, plasma-membranes surround vacuoles as well as cytoplasm. A membrane in contact with a cell-wall is an ectoplast, and a membrane surrounding a vacuole is a tonoplast. ↓ PLASMIC MEMBRANE · PLASMALEMMA · CELL WALL · ECTOPLAST · PASSIVE TRANSPORT · ACTIVE TRANSPORT · INTUSSUSCEPTION · APPOSITION ↑ CELL

CT030 plasmic membrane (*n.*) Alternative term for PLASMA-MEMBRANE.

CT031 plasmalemma (*n.*) An alternative term for plasma-membrane. The membrane is composed of lipoids and proteins, chemically combined to form lipoid-proteins. The cell membrane, from the latest evidence, is considered to have two layers of lipoid-proteins, each about 2-3 nm thick, separated by a space of about 2-3 nm. The total thickness of the membrane is about 10 nm, *i.e.* 0·01 μm. ↑ PLASMA-MEMBRANE

CT032 cell wall (*n.*) (In higher plants) the outer layer of the cell, in close contact with the plasma-membrane. The wall of newly formed cells is very thin, and formed from pectic material; as the cells mature the cell wall thickens, by the addition of cellulose. The cell wall is rigid, and gives mechanical support to the plant tissues; it is formed by the protoplasm of the cell; this is a primary cell wall. Some cell walls become further modified by suberization, by lignification, and by cuticularization (in epithelial cells);

this forms a secondary wall. ↑ PLASMA-MEMBRANE → SUBERIZATION · LIGNIFICATION CUTICULARIZATION[1,2]

CT033 ectoplast (*n.*) (In plants) the plasma-membrane in contact with the cell wall. ↑ PLASMA-MEMBRANE

CT034 passive transport (*n.*). See FE009.

CT035 active transport (*n.*). See FE010.

CT036 intussusception (*n.*) The growth in surface area of a cell wall by the formation of new cellulose between existing particles of earlier cellulose. This is the most common method of growth in plants. ↓ APPOSITION (An) ↑ PLASMA-MEMBRANE

CT037 apposition (*n.*) The growth in thickness of a cell wall resulting from successive deposition of layers of cellulose. ↑ PLASMA-MEMBRANE · INTUSSUSCEPTION (An)

CT038 vacuole (*n.*) A space in the cytoplasm of a cell; it is usually small in an animal cell, but in plants it may take up most of the cell volume. A vacuole is filled with air, water, liquid or sap. A plant cell has one vacuole; an animal cell may possess several small vacuoles, *e.g.* food vacuoles formed by amoeboid organisms. —VACUOLIZATION, VACUOLATION (*n.*) VACUOLAR, VACUOLATED (*adj.*) ↓ VACUOME · TONOPLAST · VACUOLIZATION · VACUOLATION ↑ CELL → SAP · CONTRACTILE VACUOLE

CT039 vacuome (*n.*) The vacuolar system of a single cell. ↑ VACUOLE

CT040 tonoplast (*n.*) (In plants) a plasma-membrane surrounding a vacuole. ↑ VACUOLE

CT041 vacuolization (*n.*) The formation of vacuoles. ↑ VACUOLE

CT042 vacuolation (*n.*) Alternative term for VACUOLIZATION.

CT043 nucleolus (*n.,pl.* **nucleoli**) A small, dense, round body embedded in the nuclear sap of a resting nucleus; one or several may be present. A nucleolus consists of protein and RNA; its function is to synthesize RNA and proteins in the nucleus; it disappears during mitosis. —***nucleolar*** (*adj.*) ↓ CHROMATIN · NUCLEAR RETICULUM · EUCHROMATIN · HETEROCHROMATIN ↑ CELL → RNA · RIBOSOME

CT044 chromatin (*n.*) A mass of tangled threads present in the nucleus; they take a deep stain with basic dyes and appear as a nuclear reticulum. ↑ NUCLEOLUS

CT045 nuclear reticulum (*n.*) The network of chromatin threads that become visible on staining the nucleus with basic dyes. ↑ NUCLEOLUS

CT046 euchromatin (*n.*) Parts of chromosomes showing deep staining with basic dyes during metaphase, and less dense staining during interphase; such parts contain genes with major effects on inheritance. —***euchromatic*** (*adj.*) ↑ NUCLEOLUS → METAPHASE · INTERPHASE · CHROMOSOME

CT047 heterochromatin (*n.*) Parts of chromosomes showing deep staining with basic dyes during interphase. Such parts contain genes with little or no genetical activity. Large heterochromatic regions tend to occur in sex chromosomes, particularly the Y-chromosomes of many animals. —***heterochromatic*** (*adj.*) ↑ NUCLEOLUS → SEX CHROMOSOMES

CT048 protoplasmic (*adj.*) To do with or consisting of protoplasm; the term describes the living material in a cell. ↓ ERGASTIC

CT049 ergastic (*adj.*) Describes non-living material present in a cell, *e.g.* fat or oil ↑ PROTOPLASMIC

CT050 nuclear[2] (*adj.*) Of or to do with a nucleus, *e.g.* a nuclear membrane. ↓ NUCLEATE · UNINUCLEATE · BINUCLEATE · MULTINUCLEATE · POLYNUCLEATE ↑ CELL · NUCLEUS[1]

CT051 nucleate (*adj.*) (Of a cell) possessing a nucleus, or nuclei. ↑ NUCLEAR[2]

CT052 uninucleate (*adj.*) (Of a cell) possessing one nucleus. ↑ NUCLEAR[2]

CT053 binucleate (*adj.*) (Of a cell) possessing two nuclei. ↑ NUCLEAR[2] → MACRONUCLEUS

CT054 multinucleate (*adj.*) (Of a cell or tissue) processing several or many nuclei. ↑ NUCLEAR[2]

CT055 polynucleate (*adj.*) Alternative term for MULTINUCLEATE.

CT056 vacuolar (*adj.*) To do with or like a vacuole, *e.g.* the vacuolar membrane surrounding a vacuole. ↓ VACUOLATED ↑ CELL

CT057 vacuolated (*adj.*) Possessing vacuoles, *e.g.* paramecium is vacuolated. ↑ VACUOLAR

CT058 organelle (*n.*) A part of a cell, or of a unicellular or coenocytic protist that is a structural and functional unit, *e.g.* ***a*** a flagellum is a locomotive organelle; ***b*** a mitochondrion is a respiratory organelle. Organelles in a cell correspond to organs in an organism. ↓ ORGANELLAE · MITOCHONDRION · RIBOSOME · ENDOPLASMIC RETICULUM ↑ CELL · CYTOLOGY

CT059 organellae (*n.pl.*) All the organelles in a cell. ↑ ORGANELLE

CT060 mitochondrion (*n.,pl.* **mitochondria**) A thread-like, or rod-like, granular organelle in the cytoplasm of cells, about 0.5 μm in width, and up to 10 μm in length for thread-like mitochondria. Mitochondria are bounded by a double membrane; the inner membrane is folded inwards at a number of places to form cristae. Mitochondria contain phosphates and numerous enzymes which vary in different tissues; their function is cellular respiration and the release of chemical energy, in the form of ATP, for use in most of the cell's biological functions. Cells of all organisms, except bacteria and blue-green algae, contain mitochrondria in varying numbers; mitochondria are especially numerous in cells involved in great metabolic activity, such as liver cells. Mitochondria are self-replicating. —***mitochondrial*** (*adj.*) ↓ CRISTA[1] · MESOSOME · LOMASOME ↑ ORGANELLE → ATP

CT061 crista[1] (*n., pl.* **cristae**) A fold in the inner membrane of a mitochondrion. The

folds project inwards, but leave a continuous pathway from one end to the other of the mitochondrion. The cristae are covered by granular particles when treated for negative staining, usually called **elementary particles,** which contain the enzyme systems for oxidation processes of respiration. The position of these elementary particles *in vivo* is uncertain. ↑ MITOCHONDRION

CT062 mesosome (*n.*) An organelle, homologous with the mitochondrion, occurring in bacteria. It is formed by an invagination of the plasma-membrane. Its function is the same as that of a mitochondrion. ↑ MITOCHONDRION · PLASMA-MEMBRANE

CT063 lomasome (*n.*) An organelle, similar to a mitochondrion, occurring in the hyphae and sporing structures of certain fungi. ↑ MITOCHONDRION

CT064 ribosome (*n.*) A spherical, granular organelle, about 10 to 15 nm in diameter, containing protein and RNA; it occurs mainly in the endoplasm of a cell, but also on the nuclear membrane. Most, probably all, protein synthesis takes place in ribosomes. A single molecule of messenger RNA associates with many ribosomes, forming a polysome; transfer RNA brings amino acids to the ribosome; the ribosome synthesizes polypeptide chains from the amino acids. Proteins exported from the cell are manufactured in ribosomes attached to the endoplasmic reticulum; proteins used by the cell are manufactured in free ribosomes in the cytoplasmic matrix. —***ribosomal*** (*n.*) ↓ CENTROSOME · ERGASTOPLASM ↑ ORGANELLE · CELL → ANASTOMOSIS · RNA

CT065 centrosome (*n.*) A small organelle, situated near the nucleus; it is a region of differentiated protoplasm which is the centre of activity during mitosis. It consists of a centriole and a centrosphere. ↑ RIBOSOME → CENTRIOLE

CT066 endoplasmic reticulum (*n.*) An elaborate series of membranous sacs which communicate with each other in a three-dimensional network and occcur in the endoplasm of a cell. The connection between two sacs is an anastomosis. Endoplasmic reticulum is either rough-surfaced or smooth-surfaced. Rough endoplasmic reticulum carries ribosomes on the outside surface of the sacs. Smooth endoplasmic reticulum carries no ribosomes. The functions of endoplasmic reticulum include, ***a*** the transfer of materials in cells by providing a circulatory system of channels; ***b*** the formation of lysosomes; ***c*** lipid metabolism. ↓ LYSOSOME · GOLGI APPARATUS · ERGASTOPLASM ↑ ORGANELLE

CT067 lysosome (*n.*) A membrane-bounded particle, smaller than a mitochondrion, ocurring in large numbers in the cytoplasm of plant and animal cells. They contain hydrolytic enzymes which are liberated when the cell is damaged; these enzymes assist in, ***a*** the digestion and removal of dead cells; ***b*** the digestion of food and other substances; ***c*** the destruction of redundant organelles. It is thought they are involved in autolysis and in the selective destruction of tissues controlled by development processes considered to be important in metamorphosis. ↑ ENDOPLASMIC RETICULUM → METAMORPHOSIS · LYSIS

CT068 Golgi apparatus (*n.*) A series of smooth-surfaced flattened membranous sacs, arranged roughly parallel in the endoplasm of a cell; they are associated with vesicles of varying size separately grouped round the sacs; the separate parts are Golgi bodies. In vertebrates, the cells usually have one Golgi apparatus; in invertebrates and plants, there may be several. The Golgi bodies are rich in lipids; they are probably concerned with the secretion of products from cells. Other functions attributed to Golgi apparatus include cell wall formation in plants and intracellular transport of materials. ↑ ENDOPLASMIC RETICULUM

CT069 ergastoplasm (*n.*) Alternative term for ENDOPLASMIC RETICULUM (↑).

CT070 plastid (*n.*) An organelle of varied size and shape, occurring in most plant cells; it is associated with plant nutrition and various other functions. Plastids are classified according to the pigment they contain. ↓ PRO-PLASTID · CHROMOPLAST · CELL SAP · TURGOR · MELANOPHORE · WILT · TURGID ↑ CELL

CT071 pro-plastid (*n.*) An immature plastid occurring in meristematic cells. It is colourless, bounded by a double membrane, and contains a granular stroma. Proplastids develop in mature cells into leucoplasts, chloroplasts, and other types of plastids. They multiply by division. ↓ STROMA · GRANA · THYLAKOID ↑ PLASTID

CT072 stroma (*n.*) The colourless, protoplasmic matrix of a chloroplast. Chemical energy obtained from the grana is used to reduce carbon dioxide to sugars and starches in the stroma. ↑ PRO-PLASTID

CT073 grana (*n.pl., sing.* **granum**) Minute particles, consisting of a series of disc-shaped layers (lamellae) arranged like a stack of coins, embedded in the stroma of a chloroplast. The grana contain chlorophyll and other photosynthetic pigments; the absorption of light energy and its transformation to chemical energy takes place in the grana. Grana do not occur in algae. ↑ PRO-PLASTID → CHLOROPHYLL

CT074 thylakoid (*n.*) A circular, fluid-filled sac, forming the lamellae, or disc-shaped layers, of a granum. The photosynthetic pigments are contained in the membranes of the thylakoids. ↑ PRO-PLASTID

CT075 chromoplast (*n.*) A plastid containing a pigment other than chlorophyll, usually yellow, orange or red. Chromoplasts are responsible for the colour of fruit and other plant parts, *e.g.* the red chromoplasts in carrots and tomatoes. Chromoplasts develop from leucoplasts or chloroplasts.

↓ CHROMATOPHORE · CHLOROPLAST (H) · PYRENOID · LEUCOPLAST · AMYLOPLAST · ELAIOPLAST ↑ PLASTID

CT076 chromatophore (*n.*) **1** (In plants) a chromoplast. **2** (In bacteria and blue-green algae) chromatophores are plate-like lamellae (about 50 nm in diameter) containing photosynthetic pigments. There are several thousand chromatophores distributed evenly throughout a bacterial cell of a photosynthetic bacterium. They are homologous with chloroplasts in higher plants. **3** (In animals) a cell with pigment in the cytoplasm. The colour of an animal's skin is determined by chromatophores, *e.g.* chameleons, and frogs change their colour by altering the concentration or dispersion of the pigment in the cell. Animal chromatophores include melanophores, iridophores, and xanthophores.

CT077 chloroplast (*n.*) A plastid containing chlorophyll; chloroplasts occurs in the cells of higher plants and of algae (except blue-green algae). In higher plants, a chloroplast is oval and disc-shaped, but is of varying shape in algae. In algae, chloroplasts are often accompanied by pyrenoids. A chloroplast is bounded by a double membrane and contains a colourless stroma in which grana are embedded. ↓ PYRENOID ↑ CHROMOPLAST

CT078 pyrenoid (*n.*) A colourless body, found singly, or in numbers, in the chloroplasts of many algae, but mainly absent in red and brown algae. In green algae they are associated with starch storage and are surrounded by starch deposits. ↑ CHROMOPLAST

CT079 leucoplast (*n.*) A colourless plastid occurring in plant cells which are not normally exposed to light. Different types of leucoplasts store starch, proteins or fat. They develop from pro-plastids. ↑ CHROMOPLAST

CT080 amyloplast (*n.*) A leucoplast which stores starch; amyloplasts occur in cotyledons, endosperms, and in plant storage organs. ↑ CHROMOPLAST

CT081 elaioplast (*n.*) **1** A leucoplast which stores oil; it occurs in many monocotyledons and in liverworts. **2** (In many brown algae) a chloroplast which stores oil. ↑ CHROMOPLAST

CT082 cell sap (*n.*) **1** The liquid in the vacuoles of cells, particularly plant cells. **2** The fluid constituent of a plant cell. ↓ UTRICLE[1] ↑ PLASTID

CT083 utricle[1] (*n.*) (In plant cells) the protoplasm lining the cell wall, surrounding a vacuole. ↑ CELL SAP

CT084 turgor (*n.*) (In plant cells) the normal state of a living cell, in which the cell wall is rigid, stretched by the water content of the cell. The osmotic pressure of water in the surrounding tissues tends to force water into the cell; this is balanced by the turgor pressure of the cell against the cell wall. Loss of water from a cell reduces the turgor pressure, and water then enters under osmotic pressure to raise the turgor pressure to its normal level. In this way, water is transferred from cell to cell by turgor pressure aided by osmotic pressure from water in the xylem. The turgor of a cell provides mechanical support for plant tissues □ *a cell has turgor; turgor gives rise to pressure on the cell wall* —***turgid*** (*adj.*) ↓ TURGIDITY · TURGOR PRESSURE · TURGESCENCE · PLASMOLYSIS ↑ PLASTID

CT085 turgidity (*n.*) The disposition of turgor *i.e.* the turgidity of the cell can be discussed whether the cell is turgid or flaccid. Changes in turgidity affect the opening and closing of stomata, the wilting of plants, and seismonastic plant movement □ *the turgidity measures the degree of turgor; turgor is the state of the cell, and turgidity measures the pressure due to turgor* ↑ TURGOR → STOMA[1] · SEISMONASTY

CT086 turgor pressure (*n.*) The hydrostatic pressure of water in the vacuole of a plant cell, pushing against the cytoplasm and cell wall. ↑ TURGOR

CT087 turgescence (*n.*) The process of distending cells, or tissues, by increasing internal hydrostatic pressure; the condition of cells distended in this way. In plants this is done by supplying water; in animal tissues it is done by supplying blood at increased pressure □ *turgescence in a plant cell is produced by placing the cell in a hypotonic solution* ↑ TURGOR

CT088 plasmolysis (*n.*) The shrinkage and contraction of the protoplast of a plant cell when the cell is placed in a hypertonic solution. The cell loses its turgor as water is drawn out of the central vacuole. —***plasmolysed*** (*adj.*) ↑ TURGOR

CT089 melanophore (*n.*) An animal chromatophore containing a pigment called melanin. Different concentrations of melanin can give a tissue or cell, such as skin or lymphocyte, a brown or yellow coloration. ↓ IRIDOPHORE · XANTHOPHORE · MELANIN ↑ PLASTID · CHROMATOPHORE

CT090 iridophore (*n.*) An animal chromatophore found in the reflecting tissue of skin in fishes and reptiles. ↑ MELANOPHORE

CT091 xanthophore (*n.*) An animal chromatophore containing a yellow pigment, found in crustaceans, fishes, etc. ↑ MELANOPHORE

CT092 melanin (*n.*) A dark-brown or black pigment. ↑ MELANOPHORE

CT093 wilt (*v.i.*) (Of plant tissue) to become flaccid because of lack of water; the cell walls cease being rigid, the plant loses its mechanical support and ceases being upright. —***wilt, wilting*** (*n.*) ***wilting*** (*adj.*) ↑ PLASTID

CT094 turgid (*adj.*) Describes a plant cell in which the turgor pressure is maintained at a normal level □ *the cell is turgid; the cell has turgor* —TURGIDITY (*n.*) ↓ FLACCID (Ag) ↑ PLASTID

CT095 flaccid (*adj.*) Describes a plant tissue in which the cells have been plasmol-

ysed, and the tissue has become softer and less rigid. ↑ TURGID

CT096 microsome (*n.*) A microscopic particle separated from cytoplasm by mechanically breaking up cells, and centrifuging the homogenized cell. It is formed from broken up endoplasmic reticulum and consists of vesicles with attached ribosomes. If the microsomal fraction is treated with bile salts it is split into two sub-fractions, one containing membranous vesicles and their contents, and the other containing free ribosomes. Microsomes are mainly artefacts obtained for biochemical study. —***microsomal*** (*adj.*) ↓ LYSIS · MICELLE ↑ CELL · RIBOSOME

CT097 lysis (*n.*) The destruction of a cell through rupture or other damage to the cell membrane, thus allowing the cell contents to escape into a liquid medium. —***lytic*** (*adj.*) ***lyse*** (*v.*) LYSATE (*n.*) ↓ LYSATE · AUTOLYSIS ↑ MICROSOME → HAEMOLYSIS · COMPLEMENT

CT098 lysate (*n.*) A clear culture fluid in which cells have been lysed; it contains cell debris and dissolved cell contents. ↑ LYSIS

CT099 autolysis (*n.*) The self-destruction of tissues caused by hydrolytic enzymes released from lysosomes in cells when the tissue cells are damaged. ↑ LYSIS → LYSOSOME

CT100 micelle (*n.*) A minute, somewhat elongated crystalline group of molecules forming a particle which is a unit of many structural substances. It is a hypothetical unit between the molecule and the cell, *e.g.* micelles in cellulose form a structural unit giving rigidity to the cell wall. ↓ MICELL · MICELLA ↑ MICROSOME

CT101 micell (*n.*) Alternative term for MICELLE.

CT102 micella (*n.*) Alternative term for MICELLE.

Cell Division and Function

CU001 cell division (*n.*) A cell divides in two, forming daughter cells. The cytoplasm of animal cells divides by forming a constriction; cytoplasm of plant cells divides by forming a middle lamella. The nucleus in all organisms most commonly divides by mitosis, and in a few cases by amitosis. Cells which form gametes divide by meiosis, forming four daughter cells. Unicellular animals reproduce by binary fission or by multiple fission. The term cell division is used only for somatic or sex cells. ↓ DIVIDING NUCLEUS · MITOSIS · CYTOKINESIS · BINARY FISSION · CHROMOSOME · KARYOKINESIS · REDUCTION DIVISION → CYTOLOGY

CU002 dividing nucleus (*n.*) The nucleus of any cell which is in any of the stages of cell division. ↓ METABOLIC NUCLEUS · NESTING NUCLEUS ↑ CELL DIVISION

CU003 metabolic nucleus (*n.*) The nucleus of any cell which is not undergoing cell division. ↑ DIVIDING NUCLEUS

CU004 nesting nucleus (*n.*) Alternative term for METABOLIC NUCLEUS.

CU005 mitosis (*n.,pl.* **mitoses**) The process by which a nucleus usually divides into two. The process takes place in four phases; prophase, metaphase, anaphase, and telophase. The daughter nuclei are genetically identical to each other and to the parent nucleus □ *the nucleolus disappears during mitosis* —***mitotic*** (*adj.*) ↓ MEIOSIS · AMITOSIS · ENDOMITOSIS · INTERPHASE · INTERKINESIS ↑ CELL DIVISION → KARYOKINESIS

CU006 meiosis (*n.,pl.* **meioses**) A type of nuclear division in which the final result is four haploid nuclei formed from one diploid nucleus by two successive divisions, the first and second meiotic divisions □ *during meiosis, changes in the cytoplasm accompany changes in the nucleus* —***meiotic*** (*adj.*) ↑ MITOSIS → REDUCTION DIVISION

CU007 amitosis (*n.*) A type of nuclear division in which cleavage of the nucleus takes place, instead of the usual division, as in mitosis. There is no formation of thread-like chromosomes, and the daughter nuclei apparently do not contain an identical set of chromosomes. It is uncertain whether the daughter nuclei contain a diploid number of chromosomes or not. This method of nuclear division is uncommon; it occurs in the endosperm of flowering plants and in the macronucleus of ciliates. —***amitotic*** (*adj.*) ↑ MITOSIS → ENDOSPERM[1]

CU008 endomitosis (*n.*) In endomitosis the chromosomes in a nucleus double without the nucleus undergoing division. This results in a multiplication of the number of chromosomes, leading to polyploidy. Endomitosis occurs in some plants and in some animal tissues; it is fairly common in insects, in which different tissues exhibit different degrees of polyploidy. —***endomitotic*** (*adj.*) ↑ MITOSIS → POLYPLOIDY

CU009 interphase (*n.*) The resting stage of a cell between the first and second mitotic divisions. ↑ MITOSIS

CU010 interkinesis (*n.*) Alternative term for INTERPHASE. ↑ MITOSIS

CU011 cytokinesis (*n.,pl.* **cytokineses**) The changes in the cytoplasm during mitosis or meiosis, including the separation of the cytoplasm to form two daughter cells when the nuclear changes are complete. ↓ CONSTRICTION · MIDDLE LAMELLA ↑ CELL DIVISION

CU012 constriction (*n.*) (In an animal, or a plant, cell) the narrowing of the cell between the two nuclei formed after mitosis or meiosis; the constriction gets narrower until the cell has divided in two. Constriction of the nucleus also takes place in amitosis. ↑ CYTOKINESIS

CU013 middle lamella (*n.*) Pectic compounds are deposited in the equatorial plate of a dividing plant cell to form a middle lamella; this intercellular material connects the two cells together. Cellulose is laid down on either side of the middle lamella to form the cell walls of the new cells. ↑ CYTOKINESIS → EQUATORIAL PLATE

CU014 binary fission (*n.*) Asexual reproduction in a unicellular organism, preceded by mitosis, during which the organism divides either longitudinally or transversely into two individuals. ↓ AUTOGENY · AUTOGENESIS ↑ CELL DIVISION → SCHIZOGENESIS

CU015 autogeny (*n.*) Reproduction of cells by division which increases the number of cells in an organism. ↑ BINARY FISSION

CU016 autogenesis (*n.*) Alternative term for AUTOGENY. ↑ BINARY FISSION

CU017 chromosome (*n.*) A long, thin, thread-like body in the dividing nucleus of a eucaryotic cell. Chromosomes are only observable during nuclear division. Each species of plant and animal has a constant number of chromosomes. A chromosome can be elongated, spherical, oval, or of various other shapes. The chromosomes in different species of organisms differ in shape as well as number. Chromosomes contain DNA, RNA, and protein, and these constitute the genetic material of the cell. —***chromosomal*** (*adj.*) ↓ CHROMATID · HOMOLOGOUS CHROMOSOMES · CHROMOSOME NUMBER · ALLOPOLYPLOID · DIPLOID · EUCARYOTIC ↑ CELL DIVISION → HEREDITY · GENE

CU018 chromatid (*n.*) A chromosome during the first two phases of mitosis or meiosis divides longitudinally into two strands, called chromatids, joined at a centromere. The division of a chromosome into two chromatids probably takes place during the earliest stages of the prophase ↓ DAUGHTER CHROMOSOME · CHROMOMERE · CENTROMERE ↑ CHROMOSOME → PROPHASE

CU019 daughter chromosome (*n.*) Chromatids separate at the anaphase of mitosis or meiosis and become daughter chromosomes in the new daughter cell. ↑ CHROMATID → ANAPHASE

CU020 chromomere (*n.*) A granule found on a chromosome during the prophase of mitosis or meiosis; it stains deeply. Chromomeres give chromosomes a beaded appearance. In many organisms during meiosis, chromomeres in corresponding positions on homologous chromosomes come together as a pair. ↑ CHROMATID → SYNAPSIS

CU021 centromere (*n.*) A small granule on the chromosome which does not stain. Two chromatids are joined together at the centromere, and the chromatid pair (or chromosome) is attached to the spindle at the centromere. ↑ CHROMATID → SPINDLE ATTACHMENT

CU022 homologous chromosomes (*n.pl.*) (In the somatic cells of animals and higher plants) chromosomes occur in pairs, called homologous chromosomes, the two members of each pair being identical in appearance. The pairs of chromosomes are visibly different from one another in size and shape. A nucleus has up to 100 pairs or more, depending on the species (man has 23 pairs). Gametes and gametophyte cells possess only one chromosome from each homologous pair, *i.e.* these have half the number of chromosomes of somatic cells. ↓ SEX CHROMOSOMES · AUTOSOME

CU023 sex chromosomes (*n.pl.*) In sexed animals, one sex has a pair of similar chromosomes in the nuclei of somatic cells, but the other sex has a dissimilar pair of chromosomes or only one chromosome. These are sex chromosomes, and the similar pair are called X-chromosomes. The dissimilar pair has one X-chromosome and one Y-chromosome. Somatic cells with only one sex chromosome have an X-chromosome. One sex has XX-chromosomes and the other sex has XY-chromosomes or XO-chromosomes, *i.e.* only one X-chromosome. This mechanism of sex determination is absent in hermaphrodite animals and the majority of plants. ↑ HOMOLOGOUS CHROMOSOMES

CU024 autosome (*n.*) Any chromosome which is not a sex chromosome; autosomes occur in homologous pairs in diploid nuclei. ↑ HOMOLOGOUS CHROMOSOMES

CU025 chromosome number (*n.*) The number of chromosomes present in the nucleus of somatic cells of a species of plant or animal, *e.g.* all somatic cells of human beings possess 46 chromosomes; this is the diploid number. ↓ HAPLOID NUMBER · POLYPLOIDY ↑ CHROMOSOME

CU026 haploid number (*n.*) The number of chromosomes in a haploid nucleus, *e.g.* in the nucleus of a gamete or gametophyte; it is half the diploid number. ↑ CHROMOSOME NUMBER

CU027 polyploidy (*n.*) The condition of being polyploid in an individual or species, *e.g.* the banana plant exhibits polyploidy. ↓ POLYPLOID ↑ CHROMOSOME NUMBER

CU028 allopolyploid (*n.*) A polyploid organism, with more than two sets of chromosomes, in which two different species have each contributed one or more sets of chromosomes by hybridization. —***allopolyploidy*** (*n.*) ↓ AUTOPOLYPLOID (An) · ALLOTETRAPLOID (H) ↑ CHROMOSOME

CU029 autopolyploid (*n.*) A polyploid organism, with more than two sets of chromosomes, in which the chomosomes have been contributed by parents of the same species. —***autopolyploidy*** (*n.*) ↑ ALLOPOLYPLOID (An)

CU030 allotetraploid (*n.*) A type of allopolyploid resulting from hybridization between two different species when the interspecific hybrid doubles its chromosome number by obtaining a set of chromosomes from each parent. Ordinary hybrids are sterile, but an allotetraploid is fertile, as each chromosome has a homologue with which it can pair. This results in a new species being created. Successful polyploidy is rare in animals, but occurs in plants, so allotetraploidy is only known at present in plants. —***allotetraploidy*** (*n.*) ↑ ALLOPOLYPLOID

CU031 diploid (*adj.*) Describes the nucleus of a cell which has all the autosomes in homologous pairs and a pair of sex chromosomes (or one sex chromosome in some species). Diploid nuclei are characteristic of somatic cells of animals, sporophytes of most plants, zygotes of many green algae, and many fungi □ *a diploid individual has diploid cells, each with a diploid nucleus* —***diploidy,*** DIPLOID (*n.*) ↓ HAPLOID · HEXAPLOID · TRIPLOID · POLYPLOID · HOMOGAMETIC · HETEROGAMETIC ↑ CHROMOSOME

CU032 haploid (*adj.*) Describes the nucleus of a cell which has only one of the chromosomes from a homologous pair of autosomes, and only one sex chromosome (or no sex chromosome in some species). Haploid nuclei are characteristic of : gametes of animals and plants; gametophytes of plants; spores of algae, fungi and Bryophyta; some Sporozoa; somatic cells of some animals reproduced parthenogenetically, *e.g.* male bees. —***haploidy,*** HAPLOID (*n.*) ↑ DIPLOID → GAMETE · GAMETOPHYTE

CU033 hexaploid (*adj.*) Describes a cell with six sets of chromosomes, *i.e.*, six times the haploid number. ↑ DIPLOID

CU034 triploid (*adj.*) Describes a cell with three sets of chromosomes, that is, three times the haploid number. ↑ DIPLOID

CU035 polyploid (*adj.*) Describes the nucleus of a cell which has three or more times as many chromosomes as the haploid nucleus. Polyploid individuals or species are rare in animals, but fairly common in plants. A polyploid individual is sterile if bred with a diploid individual; polyploid individuals reproduce by vegetative or parthenogenetic methods, or by self-fertilization. Allopolyploids are fertile with polyploids, a method of species formation in plants. Only plants commonly use such methods of reproduction. Polyploid individuals are common in angiosperms. Polyploid cells and polyploid tissues can occur in diploid individuals. –POLYPLOIDY, POLYPLOID (*n.*) ↑ DIPLOID · ENDOMITOSIS · ALLOPOLYPLOID

CU036 homogametic (*adj.*) Describes a sexed animal with similar sex chromosomes, *i.e.* with XX-chromosomes, in the nuclei of somatic cells □ *the homogametic sex of mammals is female* ↓ HETEROGAMETIC (I) ↑ DIPLOID

CU037 heterogametic (*adj.*) Describes a sexed animal with dissimilar sex chromosomes, *i.e.* with XY-chromosomes or XO-chromosomes. The heterogametic sex is usually male in most mammals. In butterflies, fish, reptiles, birds and some amphibians, the heterogametic sex is female. Dioecious plants have a more complex form of heterogametic sex. ↑ DIPLOID · HOMOGAMETIC (I)

CU038 eucaryotic (*adj.*) Describes a cell possessing genetic material carried on chromosomes, with the chromosomes in a nucleus which is separated from the cytoplasm by a nuclear membrane. All organisms, except bacteria and blue-green algae, possess eucaryotic cells. —***eucaryote*** (*n.*) ↓ PROCARYOTIC (An) · EUKARYOTIC · PROKARYOTIC ↑ CHROMOSOME

CU039 procaryotic (*adj.*) Describes a cell possessing genetic material in the form of a single filament of DNA, and not possessing a nucleus. The DNA is not separated from the cytoplasm as there is no nuclear membrane. Procaryotic cells are found in bacteria and blue-green algae. —***procaryote*** (*n.*) ↑ EUCARYOTIC (An)

CU040 eukaryotic (*adj.*) Alternative term for EUCARYOTIC (↑).

CU041 prokaryotic (*adj.*) Alternative term for PROCARYOTIC (↑).

CU042 karyokinesis (*n.,pl.* **karyokineses**) An alternative term for MITOSIS. ↓ CENTRIOLE · PROPHASE ↑ CELL DIVISION · MITOSIS

CU043 centriole (*n.*) The central particle of a centrosome, surrounded by an area of dense protoplasm, the centrosphere. During mitosis, the centriole divides into two and one centriole moves round the nucleus to a position diametrically opposite to the other, at opposite poles of the spindle. Each centriole is then surrounded by an aster, when present. In the cells of higher plants and in the cells of some animals there are no centrioles. ↓ ASTER · SPINDLE · EQUATORIAL PLATE · DIASTER · NUCLEAR SPINDLE · SPINDLE ATTACHMENT ↑ KARYOKINESIS

CU044 aster (*n.*) A star-shaped, non-staining structure in the cytoplasm; it surrounds a centriole during mitosis. The aster, when present, forms the pole of the nuclear spindle. The asters seem to determine the plane of cleavage of a cell. Asters are absent in the higher plants and some animals. ↑ CENTRIOLE

CU045 spindle (*n.*) A structure in the shape of a double-ended cone, formed from fibres during mitosis. The spindle is formed between the two centrioles of the dividing cell. In cells without a centriole, the pole is the point at which the spindle fibres converge. Chromatids in the dividing nucleus are attached to the spindle threads. ↑ CENTRIOLE → CHROMATID

CU046 equatorial plate (*n.*) During the metaphase of cell division, the chromosomes align themselves approximately along the equator of the spindle, *i.e.* midway between the two poles and at right angles to a line joining the two poles; this plane is

called the equatorial plate. ↑ CENTRIOLE

CU047 diaster (*n.*) The shape formed by the two groups of daughter chromosomes clustering round the two poles of the spindle during the anaphase of mitosis. ↑ CENTRIOLE

CU048 nuclear spindle (*n.*) Alternative term for SPINDLE (↑).

CU049 spindle attachment (*n.*) An alternative term for CENTROMERE. ↑ CENTROMERE · CENTRIOLE

CU050 prophase (*n.*) **1** The first stage of mitosis, in which chromosomes appear, firstly as long fine threads, and then shorten and thicken. The chromosomes split longitudinally into two equal halves, lying alongside each other. The splitting occurs either at the start of the prophase, or may have begun before the prophase is apparent. **2** The leptotene stage of meiosis. ↓ METAPHASE · ANAPHASE · TELOPHASE ↑ KARYOKINESIS → CHROMOSOME · CHROMATID · LEPTOTENE

CU051 metaphase (*n.*) The second phase of mitosis. The nuclear membrane dissolves and nucleoli disappear. A spindle is formed, and the chromatids become attached to the equatorial plate by their centromeres. ↑ PROPHASE

CU052 anaphase (*n.*) The third phase of mitosis. The centromere divides in two, the two chromatids separate, each with its own centromere, and each moves rapidly towards a pole of the cell, with the centromere leading the way. The two groups of daughter chromosomes migrate to converge on the two poles, forming a characteristic shape, the diaster. The spindle elongates, and the two groups of daughter chromosomes separate farther. ↑ PROPHASE

CU053 telophase (*n.*) The last phase of mitosis or meiosis. The daughter chromosomes elongate and finally disappear to form the chromatin; the spindle and the aster (if present) disappear, a centrosome (if present) is left near the nucleus. A nuclear membrane is formed, and nucleoli appear. Two metabolic nuclei are thus formed, and each has a centrosome (if present). The cytoplasm next divides, if cytokinesis takes place, as it does in most cases, when the metabolic nuclei are completely formed. ↑ PROPHASE → CYTOKINESIS · CENTROSOME

CU054 reduction division (*n.*) Alternative term for MEIOSIS (↑). ↓ SYNAPSIS · FIRST MEIOTIC DIVISION · SECOND MEIOTIC DIVISION ↑ CELL DIVISION

CU055 synapsis (*n.*) The pairing of two homologous chromosomes during meiosis. They lie side by side and are closely associated, forming a bivalent. —SYNAPTIC (*adj.*) ↓ BIVALENT · CHIASMA · CROSSING-OVER[1] · PAIRING · CHIASMATA ↑ REDUCTION DIVISION → CHROMOMERE

CU056 bivalent (*n.*) Two homologous chromosomes in close association during the zygotene stage of meiosis, are called a bivalent. Bivalents are formed by synapsis. ↑ SYNAPSIS

CU057 chiasma (*n.,pl.* **chiasmata**) The connecting points of chromatids of a bivalent at which a chromatid breaks and crossing-over takes place, forming a visible cross. ↑ SYNAPSIS

CU058 crossing-over[1] (*n.*) Chromatids break at chiasmata, and fuse again with a broken chromatid of the other chromosome of a bivalent. In this way, parts of chromatids are interchanged between corresponding loci on the original chromosome; this action takes place during the diplotene stage of meiosis. ↑ SYNAPSIS → LOCUS

CU059 pairing (*n.*) Alternative term for SYNAPSIS (↑).

CU060 chiasmata (*n.pl.*) The plural of CHIASMA (↑). ↑ SYNAPSIS

CU061 first meiotic division (*n.*) The division takes place in four phases: prophase, metaphase, anaphase and telophase. The prophase is extended in time, and is divided into five stages: leptotene, zygotene, pachytene, diplotene, and diakinesis. The next phase takes place in two stages; prometaphase and metaphase. The third phase is the anaphase in which half the number of chromosomes (each composed of a chromatid pair joined by a centromere) move to one pole of the nuclear spindle and the other half move to the other pole. It is a matter of chance which chromatid pair of a bivalent moves to which spindle; they may be all of maternal (or paternal) origin, but it is unlikely; the chance of this happening in the human species is 1 in 2^{23}, *i.e.* just under 1 in 8 000 000. The last phase of the division is the telophase in which cytokinesis is completed, and two daughter cells are formed, each with the haploid number of chromosomes; this may be a resting phase, or the second meiotic division may take place straight away. ↓ LEPTOTENE · ZYGOTENE · PACHYTENE · DIPLOTENE · DIAKINESIS · PROMETAPHASE ↑ REDUCTION DIVISION → MEIOSIS

CU062 leptotene (*n.*) The first stage of prophase in the first meiotic division. The chromatin is in a tangle of fine threads; the chromosomes of a diploid nucleus appear and chromomeres also appear along each chromosome. ↑ FIRST MEIOTIC DIVISION → CHROMOMERE

CU063 zygotene (*n.*) The second stage of prophase. Synapsis of homologous chromosomes takes place, forming bivalents. ↑ FIRST MEIOTIC DIVISION · BIVALENT

CU064 pachytene (*n.*) The third stage of prophase. The bivalents shorten and thicken. Each chromosome of the bivalent splits longitudinally into two chromatids, with the two chromatids joined by a centromere. ↑ FIRST MEIOTIC DIVISION → CENTROMERE

CU065 diplotene (*n.*) The fourth stage of prophase. At this stage, crossing-over of the chromosomes takes place at chiasmata; the homologous pairs separate, except at the chiasmata. ↑ FIRST MEIOTIC DIVISION · CHIASMATA

CU066 diakinesis (*n.*) The fifth and final stage of prophase. The chromatids shorten and thicken, and the pairs of chromatids, still joined at a centromere, move to the periphery of the nucleus, near to the nuclear membrane. ↑ FIRST MEIOTIC DIVISION

CU067 prometaphase (*n.*) The stage of meiosis at which the nucleoli disappear, the nuclear membrane dissolves, and a spindle is formed. This stage is followed by metaphase, in which each chromatid pair attaches itself to a spindle fibre at the centromere. These two stages correspond to the metaphase in mitosis. ↑ FIRST MEIOTIC DIVISION → SPINDLE

CU068 second meiotic division (*n.*) No prophase takes place usually as the chromosomes are still present as chromatid pairs. The sequence of events is thereafter almost identical with a mitosis for each of the two daughter cells formed in the first meiotic division. In the metaphase, the nucleoli disappear, the nuclear membrane dissolves, and a spindle is formed. The chromatid pairs line up at the equatorial plate, and the centromere of each chromatid pair divides in two. In the anaphase, one chromatid from each pair, after separation, goes to the pole of the cell, led by its centromere; the distribution of the chromatids is a matter of chance, except that one of each pair goes to one pole, and the other of each pair goes to the other pole. The chromatids now become daughter chromosomes. During the telophase, the metabolic nuclei (or resting nuclei) are formed and cytokinesis takes place, resulting in four daughter cells, two from each of the two daughter cells in the first meiotic division. Each of the four daughter cells has a haploid number of chromosomes. The distribution of chromosomes between the four daughter cells rests on chance at the anaphase of the two divisions, and on this depends the Law of Independent Assortment. ↑ REDUCTION DIVISION → MEIOSIS · INDEPENDENT ASSORTMENT

CU069 division of labour (*n.*) In Metazoa and plants, certain processes are carried out by particular cells. The cells are usually grouped in tissues or organs. The allotting of special functions to particular cells, tissues or organs, is the division of physiological labour. The morphological differentiation of cells, leading to the division of labour, increases in complexity from simple organisms, such as Protozoa, to complex organisms, such as mammals. ↓ SECRETION[1] · AMOEBOCYTE · CNIDOBLAST · SECRETE · SECRETORY ↑ CYTOLOGY

CU070 secretion[1] (*n.*) The process of secreting. Contrast **secretion** and **excretion**—*a* Material secreted is put to further use by the organism, or cell, *e.g.* gastric juice is secreted as it is used to digest food in the organism; an enzyme is secreted by a bacterium for external digestion purposes. *b* Material excreted is of no further use to the organism; it is a waste product, *e.g.* urea is excreted by some vertebrates as it is an end-product of protein metabolism, and is of no further use to the organism; ammonia is excreted by amoeboid Protozoa, as the substance is of no further use. ↓ SECRETION[2] ↑ DIVISION OF LABOUR → EXOCRINE

CU071 secretion[2] (*n.*) The material secreted by a cell or gland. The secretion can be liquid, as in a digestive juice or sebum from sebaceous glands, or it can form a solid, as in chitin secreted by epidermal cells of arthropods to form a cuticle. ↑ SECRETION[1]

CU072 amoebocyte (*n.*) A cell capable of amoeboid movement; amoebocytes are found in the body fluids and mesogloea of invertebrates. Amoebocytes in the blood of invertebrates often have a phagocytic function. ↓ CHOANOCYTE · THESOCYTE · MUSCULO-EPITHELIAL CELL ↑ DIVISION OF LABOUR

CU073 choanocyte (*n.*) A relatively large, uninucleated cell, possessing a single flagellum surrounded by a transparent, contractile collar of protoplasm; it occurs only in sponges, and as a separate organism in a small group of flagellates (Choanoflagellata). In sponges, the choanocytes ingest food, partially digest it, and pass it on to amoebocytes for completion of digestion and storage of food. ↑ AMOEBOCYTE → SPONGE

CU074 thesocyte (*n.*) (In sponges) an amoebocyte which functions as a food storage cell, distributing nutriment to other cells. ↑ AMOEBOCYTE

CU075 musculo-epithelial cell (*n.*) (In coelenterates) the commonest type of cell, characteristic of the animal; it is a columnar cell, found in sheets in the inner and outer layers of the animal. It has one or two contractile processes extending into the mesogloea. It can be capable of pseudopodial engulfing of food particles; it can also be capable of secreting digestive enzymes. By contraction of the processes, the whole body of the coelenterate can be changed in shape, or the body can perform different methods of locomotion. These cells carry out the functions of digestion and movement ↑ AMOEBOCYTE

CU076 cnidoblast (*n.*) (In some coelenterates) a specialized, pear-shaped, cell consisting of an oval bladder containing liquid, and a long, hollow, nematocyst thread, coiled inside the bladder. The thread is an invagination of the cnidoblast, and, on stimulation, the thread is discharged and shot out. There are three types of cnidoblasts: stinging cells (which occur on the tentacles of jelly-fish); coiling cells (where the thread coils round the victim); adhesive cells (where the threads are covered with an adhesive and adhere to the victim). The liquid in the bladder is toxic, and is discharged through the hollow nematocyst thread to paralyze the victim. Cnidoblasts are often arranged in batteries. ↓ NEMATOCYST · CNIDOCIL · NEMATOBLAST · THREAD-CELL ↑ DIVISION OF LABOUR

CU077 nematocyst (*n.*) The bladder in a cnidoblast. ↑ CNIDOBLAST

CU078 cnidocil (*n.*) A small process on the external surface of a cnidoblast; when it is stimulated by touch, it causes the discharge of the nematocyst thread. ↑ CNIDOBLAST

CU079 nematoblast (*n.*) The cell from which a cnidoblast develops. When a cnidoblast has discharged its nematocyst thread, it degenerates and is replaced by a new cnidoblast. ↑ CNIDOBLAST

CU080 thread-cell (*n.*) Alternative term for CNIDOBLAST (↑).

CU081 secrete (*v.t.*) To pass out elaborated material from within a cell to outside the plasma-membrane. The elaborated material is usually a complex organic substance which has been produced by the cell from metabolites it has absorbed or synthesized. Gland-cells specialize in secreting. —SECRETION (*n.*) SECRETIVE, SECRETORY (*adj.*) ↑ DIVISION OF LABOUR

CU082 secretory (*adj.*) Effecting a secretion, *e.g.* a secretory cell is one that produces a secretion. ↓ SECRETIVE ↑ DIVISION OF LABOUR

CU083 secretive (*adj.*) Of or to do with the process of secreting, *e.g.* the production of chitin to form a cuticle is a secretive process. ↑ SECRETORY

Chemical Bonds

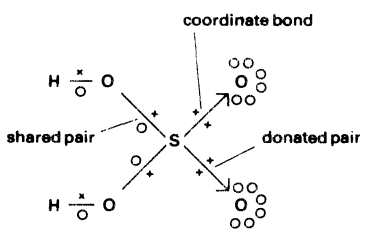
DA001 chemical bond (*n.*) A force which holds particles (atoms, ions, or radicals) together in a molecule or ionic crystal. Chemical bonds are the forces which must be overcome when particles are separated in chemical change, and they are the new forces set up to form new arrangements, *e.g.* the reaction traditionally represented as: $CaCO_3 \rightarrow CaO + CO_2$ is better studied as: $Ca^{2+}CO_3^{2-} \rightarrow Ca^{2+}O^{2-} + CO_2$. A complex interchange of electrons takes place in the carbonate ion: $CO_3^{2-} \rightarrow O^{2-} + CO_2$, and the Ca^{2+} and O^{2-} form $Ca^{2+}O^{2-}$. ↓ IONIC BOND · IONIZATION ENERGY · BOND ENERGY · ORBITAL OVERLAP · CATENATION

DA002 ionic bond (*n.*) A type of chemical bond formed between ions. It is more usually formed between metallic elements and nonmetallic elements. Metallic elements have low ionization energy and low electronegativity, while nonmetallic elements have high ionization energy and high electronegativity. Metallic element atoms lose electrons to become positive ions with no unpaired electrons in their valence shells, *e.g.* Mg (2.8.2) loses two electrons to become Mg^{2+} (2.8). The reverse process takes place with nonmetals, *e.g.* Cl (2.8.7) gains one electron to become Cl^- (2.8.8). If Mg atoms and Cl atoms are suitably placed and in suitable energy states, transfer of electrons takes place to form $Mg^{2+}2Cl^-$, which is the compound known as magnesium chloride. In ionic bonding there are no simple molecules. The compound is made up of large numbers of ions with opposite charges. ↓ COVALENT BOND · COORDINATE BOND · HYDROGEN BOND · METALLIC BOND · VAN DER WAALS BOND ↑ CHEMICAL BOND

DA003 electrovalent bond (*n.*) Alternative term for IONIC BOND (↑) The term now preferred is ionic bond.

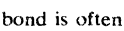
DA004 covalent bond (*n.*) A type of chemical bond formed by sharing pairs of electrons. Covalent bonds are formed when the ionization energies and electronegativities of the atoms are equal or nearly equal, *e.g.* chlorine (2.8.7) shares electrons with another chlorine atom; each atom contributes one shared electron and thus has the electron configuration 2.8.8. The bonding in methane is shown in the diagram at DA031. Compounds formed by covalent bonding are of two types. Some are made up of molecules (Cl_2, CCl_4, etc.) and are gases, liquids, or low-melting solids. In others (such as diamond and boron nitride) the covalent bonds extend through the crystal. These are hard, high-melting solids. ↑ IONIC BOND

DA005 coordinate bond (*n.*) A type of covalent bond formed between two atoms in which one atom provides both electrons for the shared pair. The elements which show this type of bonding have, in their atoms, an unused pair of electrons (lone pair).



sulphuric acid (VI)

This type of bond is often represented as A → B, the arrow pointing to the atom receiving the electron pair:



Because the donation of a pair of electrons modifies the balance of charge, the bond is sometimes written:

$$A^{\oplus}-B^{\ominus}$$

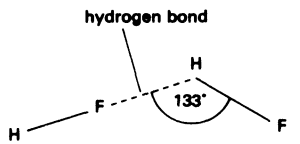
↑ IONIC BOND

DA006 dative covalent bond (*n.*) Alternative name for COORDINATE BOND.

DA007 dative bond (*n.*) Alternative name for COORDINATE BOND.

DA008 semipolar bond (*n.*) Alternative name for COORDINATE BOND. ↑ IONIC BOND

DA009 hydrogen bond (*n.*) A type of bond formed by a hydrogen atom between two atoms of high electronegativity. The bond is often written – – – –, as in the compound A – H – – – – B. It occurs with oxygen, fluorine, and nitrogen atoms. Thus hydrogen bonds exist between HF molecules in solid hydrogen fluoride, and between H_2O molecules in water and ice:



Because atoms of high electronegativity attract electrons, the single electron is drawn away from the hydrogen nucleus, leaving the small positively charged proton to make an electrostatic bond with another fluorine atom. ↑ IONIC BOND

DA010 hydrogen bridge (*n.*) An alternative name for a HYDROGEN BOND, thought of as a hydrogen atom joining (**bridging**) two atoms of high electronegativity.

DA011 metallic bond (*n.*) A type of bond occurring in solid metals. In metallic bonding an arrangement of positive metal ions is held together by free electrons. ↑ IONIC BOND

DA012 van der Waals bond (*n.*) A comparatively weak bond (force) which holds the molecules together in molecular crystals and which holds molecules together in liquids. Molecular crystals have low melting points, *i.e.* only a small amount of energy is needed to overcome van der Waals forces. ↑ IONIC BOND

DA013 v.d.W. An abbreviation for VAN DER WAALS (↑).

DA014 ionization energy (*n.*) The energy required to remove an electron from an atom against the attraction of the nuclear charge, to infinity. It is, in simple terms, a measure of the ease with which an electron can be removed from an atom. To remove the outermost (valency) electron from sodium ($Na \rightarrow Na^+ + e$) the energy required is 497·9 kJ mol^{-1}. This may be compared with 1260 kJ mol^{-1} for chlorine ($Cl \rightarrow Cl^+ + e$). This is called the first ionization energy. The second ionization energy will be the energy required to remove the next electron. ↓ IONIZATION POTENTIAL · ELECTRONEGATIVITY · ELECTRON AFFINITY ↑ CHEMICAL BOND

DA015 ionization potential (*n.*) An alternative term for IONIZATION ENERGY, especially when given in electron volts.

DA016 electronegativity (*n.*) The power of one atom in a compound to draw electrons to itself. In hydrogen chloride gas, HCl, the electron pair shared by the two atoms is attracted to the chlorine atom because of its greater electronegativity (H 2.1; Cl 3.0). No absolute values are given to electronegativity but comparative values have been obtained by some scientists. Mulliken arrived at an electronegativity scale by using the arithmetic mean of an atom's ionization energy and its electron affinity. ↑ IONIZATION ENERGY

DA017 electron affinity (*n.*) The energy given out when an electron is added to an atom, *e.g.*:

$Cl + e \rightarrow Cl^-$ $\Delta H = -389{\cdot}1$ kJ mol^{-1}

Note that for energy given out, ΔH is negative. ↑ IONIZATION ENERGY

DA018 bond energy (*n.*) The energy given out when a covalent bond is formed between two free atoms. The bond energy is a useful measure of the strength of the bond, *e.g.* the bond energy of H – H in H_2 is 436 kJ mol^{-1}. ↓ LATTICE ENERGY · SOLVATION ENERGY ↑ CHEMICAL BOND

DA019 lattice energy (*n.*) The energy per mole required to separate the ions in an ionic crystal so that the distance between them is very great. ↑ BOND ENERGY → CRYSTAL · ION · IONIC

DA020 solvation energy (*n.*) The amount of energy released or generated when one mole of ions combines with a solvent. → SOLUTION · ION

DA021 electron pairing (*n.*) The process whereby an orbital is completed and a bond may be formed. Each orbital when filled contains two electrons which differ only in their spin quantum number, which are of opposite sign. The orbital may be filled by transfer from another element, *e.g.* Na loses an electron to Cl forming Na^+ and Cl^-. The Cl contains four pairs of electrons whereas Cl contains an unpaired electron. In a covalent bond pairing is achieved by sharing. ↓ ORBITAL OVERLAP · STABLE OCTET

DA022 orbital overlap (*n.*) The process by which electrons are shared in forming covalent bonds. Orbital overlapping may form σ bonds (sigma bonds) either by two *s*-orbitals, two *p*-orbitals or one *s*-orbital and one *p*-orbital or by parallel overlap forming a π-bond (pi bond). ↑ ELECTRON PAIRING · CHEMICAL BOND

DA023 stable octet (*n.*) The periods of the periodic table fit in with electron arrangements of the shells. Shell one has a maximum of two electrons. This produces a stable state, *e.g.* a hydrogen atom has only one electron; a hydrogen molecule shares a pair of electrons giving each a complete shell of two. In periods 2 and 3 the completed outer shell has 8 electrons. Neon and argon atoms both have outer shells of 8 electrons, *i.e.* a stable octet. An atom may

achieve a stable octet, ***a*** by receiving electrons

$$Cl\ 2.8.7. \rightarrow Cl^- 2.8.8.$$
$$O\ 2.8.6. \rightarrow O^{2-} 2.8.8.$$
$$N\ 2.5. \rightarrow N^{3-} 2.8.$$

b by losing electrons

$$Na\ 2.8.1. \rightarrow Na^+ 2.8.$$
$$Mg\ 2.8.2. \rightarrow Mg^{2+} 2.8.$$
$$Al\ 2.8.3. \rightarrow Al^{3+} 2.8.$$

c by sharing pairs of electrons

$$2Cl \rightarrow Cl_2$$
$$S + 2H \rightarrow H_2S$$
$$N + 3H \rightarrow NH_3$$
$$C + 4H \rightarrow CH_4$$

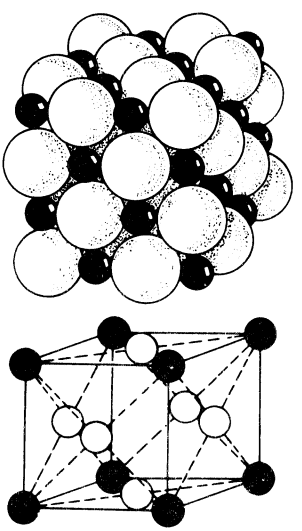
d by receiving pairs of electrons by donation

$$NH_3 + H^+ \rightarrow NH_4^+$$

↑ ORBITAL OVERLAP

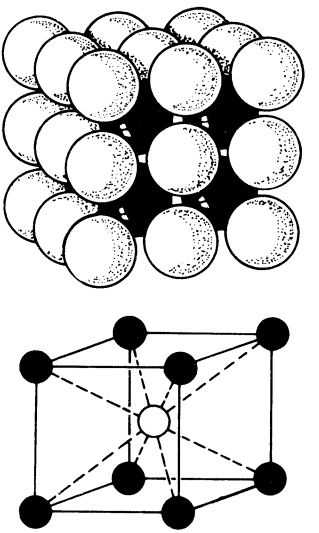
DA024 catenation (*n.*) The disposition to form chains of atoms, *e.g.* ***a*** the carbon atom forms hydrocarbon chains C_nH_{2n+2}; ***b*** some other elements form chains, although shorter ones, *e.g.* sulphur S_8 in the solid state. Catenation can also take place between atoms of different elements, *e.g.* ***a*** the chains of oxygen and phosphorus atoms in phosphoric acids; ***b*** beryllium and chlorine in beryllium chloride. ↑ CHEMICAL BOND · IONIZATION ENERGY

DA025 ionic crystal (*n.*) A solid structure of ions held together by electrostatic forces (ionic bonds). The form of the crystal is determined by the radii of the ions and by their charges. Sodium chloride forms face-centred cubes. Caesium chloride, however, has a larger ionic radius and therefore the ratios of the Cs^+ radius and the Cl^- radius do not allow a face-centred cube to form. In a compound $M^{2+}2X^-$, such as CaF_2, a different structure is formed. ↓ FACE-CENTRED CUBE ↑ CHEMICAL BOND



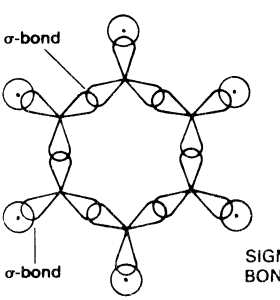
FACE-CENTRED CUBE

DA026 face-centred cube (*n.*) A form of cubic lattice in which the cubes have a point at the centre of each face in addition to the points at the corner. Sodium chloride crystallizes in this form with Na^+ at the corners of the cube and Cl^- in the centre of the face. Fitting into this will be face-centred cubes with Cl^- at the corners and Na^+ in the centre of the faces. ↓ BODY-CENTRED CUBE ↑ IONIC CRYSTAL



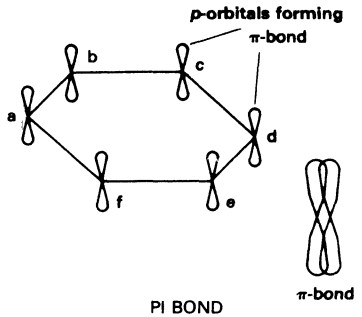
BODY-CENTRED CUBE

DA027 body-centred cube (*n.*) A cubic lattice modified by having an additional point at the centre of the body of the cube and equidistant from the corners. Caesium chloride is a structure containing body-centred cubes with Cs^+ at the body centre position. ↑ FACE-CENTRED CUBE



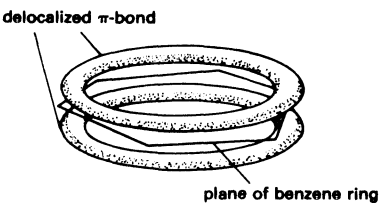
DA028 sigma bond *or* **σ-bond** (*n.*) A co-

valent bond formed by orbital overlap between two *s*-orbitals, an *s*-orbital and a *p*-orbital or two *p*-orbitals. ↑ COVALENT BOND



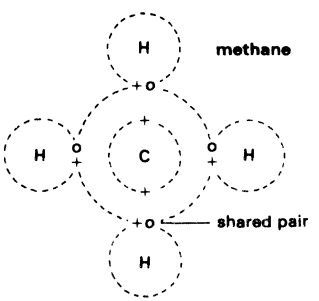
PI BOND

DA029 pi bond *or* **π-bond** (*n.*) A covalent bond formed when two *p*-orbitals overlap with their axes parallel to one another. Such bonds occur in ethene and in benzene. ↑ COVALENT BOND



DELOCALIZED BOND

DA030 delocalized bond (*n.*) A bond in which the energy of *p*-electrons is spread over a number of π-bonds instead of being localized in a single bond. Such a bond exists in benzene and in straight chain organic compounds with alternate single and double bonds between carbon atoms. The nitrate and carbonate ions are further examples. —***delocalization*** (*n.*) ↑ COVALENT BOND



SHARED PAIR

DA031 shared pair (*n.*) The pair of electrons, one from each atom, which forms the bond when a covalent bond is formed between two atoms. ↑ COVALENT BOND

DA032 hybridization (*n.*) A process by which atomic orbitals of different types in the same quantum shell (same principal quantum number) combine to form an equal number of equivalent orbitals.
one *s* and one *p* form two *sp* orbitals
one *s* and two *p* form three sp^2 orbitals
one *s* and three *p* form four sp^3 orbitals
one *s* and three *p* and one *d* form five sp^3d orbitals
one *s* and three *p* and two *d* form six sp^3d^2 orbitals
These hybrid orbitals are responsible for the geometry of the molecules.

C

1	2			
s	*s*	*p*		
↿⇂	↿⇂	1	1	

ground state

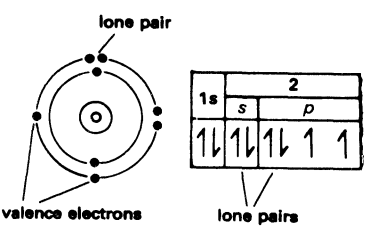
→ C

1	2			
s	*s*	*p*		
↿⇂	1	1	1	1

activated state

→ forms four sp^3 orbitals

↑ σ-BOND · COVALENT BOND



LONE PAIR

DA033 lone pair (*n.*) Two paired electrons in the valence shell of an atom. They can be used to form coordinate bonds by donation of the pair to form a shared pair with another atom, *e.g.* nitrogen has 5 electrons in its valence shell: three of these are unpaired, the other two form a lone pair available for donation. The presence of this lone pair in the nitrogen atom in the ammonia molecule allows NH_3 to form complex ions of the type $Cu(NH_3)_4^{2+}$
↓ DONOR[1] · ACCEPTOR ↑ CHEMICAL BOND · COORDINATE BOND

DA034 donor[1] (*n.*) Anything which gives something. In chemistry it applies to chemical species which supply something, *e.g.* ***a*** an acid is a proton donor; ***b*** a reducing agent is an electron donor; ***c*** the atom or group with the lone pair in a coordinate bond is the donor. ↓ ACCEPTOR (P)

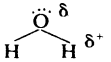
DA035 acceptor (*n.*) A chemical species which accepts something, *e.g.* ***a*** a base is a proton acceptor; ***b*** an oxidizing agent is an electron acceptor; ***c*** the atom or group which accepts the lone pair in a coordinate bond is the acceptor. ↑ LONE PAIR

DA036 ligand (*n.*) An ion or molecule with one or more lone pairs of electrons which it can donate to a central metallic atom or ion. The ligands form coordinate bonds to produce a complex ion or molecule, such as $[Cu(H_2O)_4]^{2+}$, $[CuCl_4]^{3-}$, etc. → ION · COMPLEX ION

DA037 polar liquid (*n.*) A liquid which has molecules which have a dipole moment. Such liquids have good solvating power and are good solvents for ionic compounds, *e.g.* water is a polar liquid and its molecules have a dipole moment of 1·84 Debye units. ↓ POLAR SOLVENT ↑ COORDINATE BOND

DA038 polar solvent (*n.*) Any polar liquid which is used as a solvent. ↑ POLAR LIQUID

DA039 polar (*adj.*) Describes a molecule that has an unequal distribution of charge, *e.g.* the water molecule



has a more negative end on the oxygen atom and a more positive end on the hydrogen atoms. The term is also applied to a solvent the molecules of which are polar. —POLE, POLARIZE, POLARIZATION (*n.*) ↓ NON-POLAR ↑ LONE PAIR · COORDINATE BOND

DA040 non-polar (*adj.*) Describes molecules which have no imbalance of charge; also used of solvents which contain such molecules, such as methyl benzene (toluene). ↑ POLAR (P)

DA041 anneal (*v.t.*) To heat a metal to a high temperature, keeping it at the high temperature for a time suitable to the metal. After this the hot metal is allowed to cool slowly. This process removes strains and imperfections from the crystal. —***annealing*** (*n.*) ***annealed*** (*adj.*) → METALLIC BOND

Atomic Structure

DB001 atomic structure (*n.*) An atom consists of two main parts, ***a*** a nucleus which provides the mass of the atom and has positive charge varying in number according to the element; ***b*** an arrangement of electrons in shells and within the shells in orbitals according to the energy levels of the electrons. Each electron has a negative charge. The atom as a whole is a neutral particle. → STRUCTURE OF THE MOLECULE · SOLUTION · DISPERSE SYSTEMS · IONIC THEORY · COLLOID ↓ NUCLEUS[3] · ENERGY LEVEL · ISOTOPE · S-ORBITAL

DB002 nucleus[3] (*n.,pl.* **nuclei**) The part of an atom which gives the atom its mass. It is positively charged. The charge of the nucleus is Ze where Z is the atomic number of the element and e is a charge equal in magnitude to that of the electron. A nucleus consists of protons and neutrons except in hydrogen, which has only a proton. The number of protons is equal numerically to the atomic number (Z). The number of neutrons is numerically equal to the difference between the mass number (A) and the atomic number (Z) of the element, *i.e.*

number of neutrons = $A - Z$.

↓ PROTON · NEUTRON · ELECTRON · POSITRON ↑ ATOMIC STRUCTURE → RADIOACTIVITY

DB003 proton (*n.*) A fundamental particle present in all atoms. It is positively charged and its mass is $1{\cdot}672 \times 10^{-27}$ kg. This mass is approximately 1840 times that of an electron. If an electron is said to have charge −1 then a proton has charge +1. ↑ NUCLEUS[3] → ATOM

DB004 neutron (*n.*) A fundamental particle having no charge and a mass of $1{\cdot}675 \times 10^{-27}$ kg. It is present in all atomic nuclei except that of hydrogen. Outside the nucleus, neutrons are unstable and decay. The half-life of a free neutron is approximately 780 s. ↑ NUCLEUS[3] → ATOM

DB005 electron (*n.*) A fundamental particle of mass $9{\cdot}109 \times 10^{-31}$ kg. It is negatively charged and carries a charge of 1.602×10^{-19} coulomb. In chemistry this is conveniently called a unit charge. Its mass is approximately $^1/_{1840}$ of the mass of a proton. ↑ NUCLEUS[3] → ATOM

DB006 positron (*n.*) A fundamental particle which has the same mass as an electron but a positive charge equal in magnitude to that of an electron. The positron is the antiparticle of the electron. ↑ NUCLEUS[3] → RADIOACTIVITY

DB007 energy level (*n.*) Electrons possess energy according to their position in relation to the nucleus. The closer the electron is to the nucleus the lower the energy. When the energy of an electron changes, it must do so in certain definite steps and not in a continuous way. The positions in which electrons may be found according to their energy are called energy levels and sublevels. These levels are counted by their steps outwards and the numbers allotted to them are their quantum numbers. If an elec

tron is activated (given more energy) the electron moves to an energy level further from the nucleus. If an electron moves back to a lower level, energy is given out as electromagnetic radiation. ↓ QUANTUM SHELL · SHELL[2] · ORBITAL ↑ ATOMIC STRUCTURE

DB008 quantum shell (*n.*) A quantum shell is a space in which electrons are to be found which all have the same principal quantum number. This implies that they occupy energy sublevels within the main level division. They are indicated by their principal quantum numbers, 1, 2, 3, 4, etc. They are sometimes indicated by the letters K, L, M, etc. which indicate the different series of lines in the characteristic X-ray spectrum of the element. The K shell is so named because the K lines result from electron transitions from outer shells back to the K shell of the atom. ↓ SHELL[2] · ORBITAL ↑ ATOMIC STRUCTURE

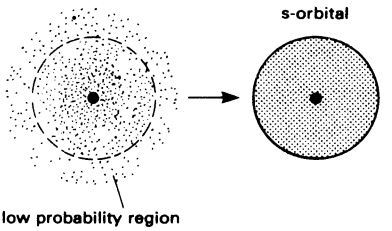
DB009 shell[2] (*n.*) An abbreviation of **quantum shell**. ↑ ENERGY LEVEL

DB010 orbital (*n.*) The principal quantum number of an electron gives us one piece of information about the electron. Another important piece of information is given by another quantum number associated with both energy and position. This is the type of orbital. This has nothing to do with orbit or revolution round a centre. It is a space: within that space there may be one or two electrons (not more). Their energy must be correct for the orbital. Their positions can only be stated as a probability. Certain points in the orbital have higher probability than others. These orbitals are of four kinds represented by the letters *s*, *p*, *d* and *f*. ↑ ENERGY LEVEL

DB011 isotope (*n.*) A variety of an element which has the same atomic number as other varieties but a different mass number. There are two isotopes of chlorine, one with mass number of 35 and the other with a mass number of 37. Both have atomic number 17. It follows that isotopes have atoms with the same number of protons but different numbers of neutrons. Chlorine 35 (^{35}Cl) has 17 protons and 18 neutrons; chlorine 37 (^{37}Cl) has 17 protons and 20 neutrons. —***isotopic*** (*adj.*) ↓ ISOTOPIC RATIO ↑ ATOMIC STRUCTURE

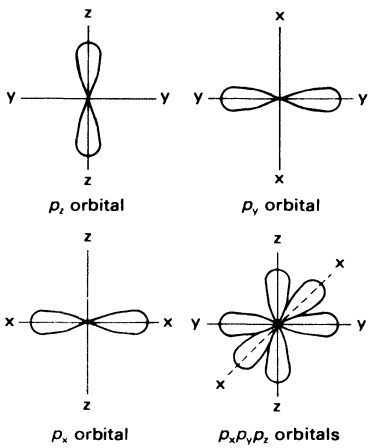
DB012 isotopic ratio (*n.*) The ratio of the amounts of different isotopes present in a sample of an element. The ratio has a fixed value when the element is obtained from natural sources. ↑ ISOTOPE

DB013 *s*-orbital (*n.*) An orbital which is spherically symmetrical about the nucleus. The *s*-orbital can contain only two electrons. Electrons in *s*-orbitals have the lowest energy of the electrons in any shell. They are usually described as 1*s*, 2*s*, etc. orbitals when the number is the principal quantum number of the shell. The electron of the hydrogen may be symbolized as 1*s* while two electrons of helium may be symbolized as $1s^2$. ↓ P-ORBITAL · D-ORBITAL ↑ ATOMIC STRUCTURE



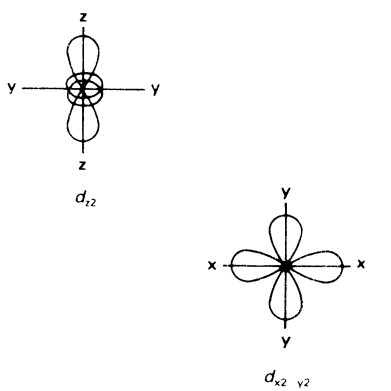
S-ORBITALS

DB014 *p*-orbital (*n.*) These are orbitals which have 2 lobes and a 'dumb-bell' shape:

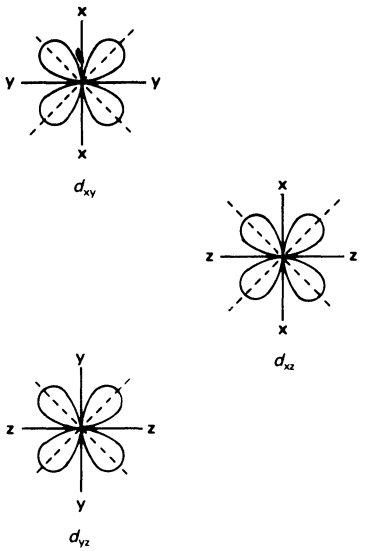


P-ORBITALS

They are directional along three axes at right angles. They are shown as P_x, P_y and P_z according to the axis about which they are symmetrical. They occur in shells 2, 3, etc. Electrons in *p*-orbitals have higher energy than electrons in corresponding *s*-orbitals. ↑ S-ORBITAL



D-ORBITALS



D-ORBITALS

DB015 *d*-orbital (*n.*) An orbital which has the next greater energy after a *p*-orbital in any given shell or with any given principal quantum number. There are five *d*-orbitals in each shell, each for two electrons. Four of these orbitals have four lobes and one has a different shape. In the absence of an external field all five *d*-orbitals have equal energy, as between one shell and another there may be overlap of energy, for example 3*d* has a higher energy than 4*s*. ↑ S-ORBITAL

DB016 atomic number (*n.*) (Of an element) a number equal to the number of protons in the nucleus of the atom of the element. It can also be defined as the number of unit positive charges carried by the nucleus of the atom. H. J. C. Moseley (1913) showed that the X-ray spectra of various elements were connected with atomic number by the equation:

$$(1/\lambda)^{\frac{1}{2}} = a(Z - b)$$

λ is the wavelength of the characteristic X-ray spectrum; Z is the atomic number of the element; a and b are constants. ↓ MASS NUMBER · RELATIVE ISOTOPIC MASS · ISOTOPIC WEIGHT

DB017 mass number (*n.*) The sum of the number of protons and the number of neutrons in the nucleus of an atom. It should be more precisely stated as *mass number of an isotope*, since it cannot properly be given for an element. ↑ ATOMIC NUMBER

DB018 relative isotopic mass (*n.*) The relative isotopic mass of an isotope of an element is the ratio of the mass of one atom of the isotope to one twelfth of the mass of one atom of ^{12}C.

$$\text{relative atomic mass} = \frac{\text{mass of 1 atom of the isotope}}{1/12 \times \text{mass of 1 atom of } ^{12}C}$$

↑ ATOMIC NUMBER

DB019 isotopic weight (*n.*) Obsolete term for RELATIVE ISOTOPIC MASS. ↑ ATOMIC NUMBER

DB020 relative atomic mass (*n.*) (Of an element) the ratio of the mass of one atom of the element to one twelfth of the mass of one atom of ^{12}C. A more precise definition is the ratio of the average mass per atom of a specified isotopic composition of an element to one-twelfth of the mass of an atom of the nuclide ^{12}C. ↓ ATOMIC WEIGHT · ATOMIC MASS UNIT ↑ ATOMIC STRUCTURE

DB021 atomic weight (*n.*) Obsolete term for relative atomic mass. ↑ RELATIVE ATOMIC MASS

DB022 atomic mass unit (*n.*) A mass equal to one twelfth of the mass of one carbon atom. Its value is $1{\cdot}66043 \times 10^{-27}$ kg. Its symbol is amu. The mass of any one atom can be obtained by multiplying the relative isotopic mass by the atomic mass unit. ↑ RELATIVE ATOMIC MASS

Molecular Structure

DC001 structure of the molecule (*n.*) Because a molecule is made up of covalently bonded atoms and some of those bonds are directed in space, molecules have a definite shape. These shapes result from the directional positions of electrons in atoms. The important shapes are tetrahedral, trigonal, linear, trigonal bipyramidal, and octahedral. ↓ MOLECULAR LATTICE · RELATIVE MOLECULAR MASS · TETRAHEDRAL · VALENCY · MOLECULAR CRYSTAL → MOLECULE

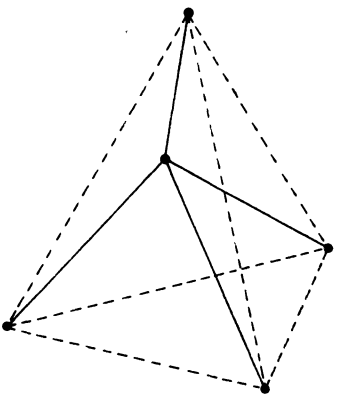
DC002 atomicity (*n.*) The number of atoms in a molecule of an element or compound. Thus, chlorine has an atomicity of 2 (Cl_2), carbon dioxide has an atomicity of 3 (CO_2), argon has an atomicity of 1. → MOLECULE

DC003 covalent lattice (*n.*) A lattice in which the chemical species are joined together by covalent bonds. This covalent bonding continues indefinitely in two or three dimensions. Thus in diamond the covalent bonding is continuous through the crystal. ↓ MOLECULAR LATTICE ↑ STRUCTURE OF THE MOLECULE

DC004 molecular lattice (*n.*) A lattice consisting of molecules held together by hydrogen bonds or by van der Waals forces. Thus water forms a molecular lattice in which H_2O molecules are held together by hydrogen bonds. Solid white phosphorus has a molecular lattice in which P_4 molecules are held together by van der Waals forces. ↑ COVALENT LATTICE

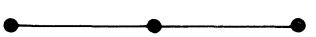
DC005 relative molecular mass (r.m.m.) (*n.*) (Of an element or compound) the ratio of the mass of one molecule of the element or compound to one twelfth of the mass of one atom of ^{12}C. It is given the symbol of M_r. Relative molecular mass is equal to the sum of the relative atomic masses of all the atoms in the molecule. ↓ MOLECULAR WEIGHT ↑ STRUCTURE OF THE MOLECULE

DC006 molecular weight (*n.*) Obsolete term for RELATIVE MOLECULAR MASS. ↑ RELATIVE MOLECULAR MASS



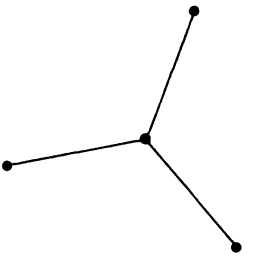
TETRAHEDRAL

DC007 tetrahedral (*adj.*) Having the shape of a tetrahedron. This is a solid figure with four faces each of which is an equilateral triangle. A molecule is said to be tetrahedral if it has a central atom with four bonds directed towards the corners of a tetrahedron. Thus methane (CH_4) and the sulphate ion (SO_4^{2-}) both have tetrahedral shapes. ↓ LINEAR[1] · TRIGONAL PLANAR · TRIGONAL PYRAMIDAL · TRIGONAL BIPYRAMIDAL · OCTAHEDRAL ↑ STRUCTURE OF THE MOLECULE



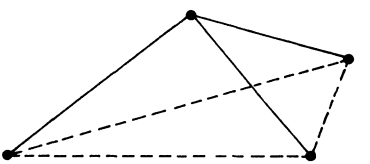
LINEAR

DC008 linear[1] (*adj.*) In a straight line. Linear molecules have all their atoms in a line. Carbon dioxide is a common example. ↑ TETRAHEDRAL



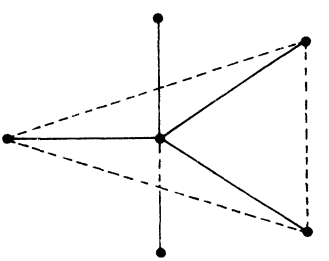
TRIGONAL PLANAR

DC009 trigonal planar (*adj.*) Describes a molecule or ion that has a central atom bound to three other atoms arranged in a plane. The NO_3^- ion and the CO_3^{2-} ion both have this shape. Sulphur trioxide SO_3 also has this shape. ↑ TETRAHEDRAL



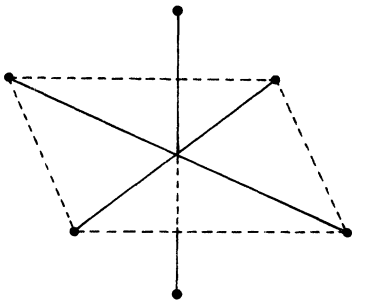
TRIGONAL PYRAMIDAL

DC010 trigonal pyramidal (*adj.*) Describes a molecule or ion in which a central atom is attached to three other atoms, but the atoms attached to the central atom are not in the same plane as the central atom. In ammonia (NH_3) the nitrogen atom is the central atom with the three hydrogen atoms lying in a different plane. ↑ TETRAHEDRAL



TRIGONAL BIPYRAMIDAL

DC011 trigonal bipyramidal (*adj.*) Describes a molecule or ion with a trigonal base with a triangular pyramid above and below. Phosphorus pentachloride (PCl_5) has this structure. ↑ TETRAHEDRAL



OCTAHEDRAL

DC012 octahedral (*adj.*) Describes a solid figure with eight faces. The sulphur hexafluoride molecule (SF_6) has this shape with the sulphur atom at the centre and the fluorine atoms at the six corners. ↑ TETRAHEDRAL

DC013 valency (*n.*) The disposition of atoms of an element or a particular group of atoms to form bonds. The term was used originally to describe the combining power of an atom as observed by experiment. There was at that time no theory of how such combination took place. It is customary now to use instead the terms **electrovalency** and **covalency** as well as oxidation number and oxidation state. ↑ STRUCTURE OF THE MOLECULE

DC014 electrovalency (*n.*) The number of electrons which an atom of an element has available for transfer to another element in the case of metallic elements, and the number of unpaired electrons available for pairing by electron transfer from an atom of a metallic element. The electrovalency of sodium is plus one because sodium has one electron available for transfer. Chlorine has an electrovalency of minus one because it has 7 electrons in its outer (valence) shell and can accept one electron to form a pair. The two elements form Na^+Cl^-. The electrovalency of an element is shown by the ionic charge of its ions:
sodium Na^+ electrovalency +1
calcium Ca^{2+} electrovalency +2
oxygen O^{2-} electrovalency −2
↓ COVALENCY ↑ VALENCY

DC015 covalency (*n.*) The number of unpaired electrons which an atom of an element has available for sharing with another atom to form covalent bonds, *e.g.* nitrogen has a covalency of 3 as it has 3 unpaired electrons available for forming covalent bonds. ↑ ELECTROVALENCY

DC016 valence shell (*n.*) The outermost shell of an atom, containing the electrons normally used for bonding. ↓ VALENCE ELECTRON ↑ VALENCY

DC017 valence electron (*n.*) An electron used in forming chemical bonds. ↑ VALENCE SHELL

DC018 oxidation state (*n.*) The oxidation state of an element in an ionic compound is represented by the charge on the ion of the element, *e.g.* for iron $-Fe^{2+}$ it is +2; for iron $-Fe^{3+}$ it is +3; for chlorine $-Cl^-$ it is −1. The oxidation states of elements in covalent compounds are obtained in an arbitrary way by taking the oxidation state which each of the elements would have had if the bonds had been ionic. The algebraic sum of the oxidation states of the individual atoms is equated to the charge on the ion or atom, *e.g.* ***a*** in phosphoric acid (H_3PO_4) each hydrogen has +1 and each oxygen −2 thus phosphorus is +5; ***b*** in nitrogen dioxide (NO_2) each oxygen is −2, thus N is +4; ***c*** in the ion PbO_2^{2-} each oxygen is −2, and the charge on the ion is −2, thus Pb is +2 (plumbate (II)). ↓ OXIDATION NUMBER

DC019 oxidation number (*n.*) A number giving the oxidation state of an atom in a compound. It is written in roman numerals in the compound name. Thus copper (II) sulphate is $CuSO_4$, the copper is in the +2 oxidation state. The zincate (II) ion is ZnO_2^{2-}; the zinc is in the +2 oxidation state. ↓ OXIDATION STATE

DC020 molecular crystal (*n.*) A crystal made up of molecules held together by van der Waals forces or by hydrogen bonds. The structure forms a molecular lattice. Molecular crystals have low melting points compared with ionic crystals. ↑ STRUCTURE OF THE MOLECULE → IONIC CRYSTAL (I)

Solutions

DD001 solution (*n.*) A homogeneous mixture of two or more substances. More precisely it is a disperse system in which the dispersed particles are molecules and ions of diameter less than 10^{-3} nm. A true solution differs however from a disperse system in that it is a single phase The type of solution most usual is one of a solid in liquid. If the liquid is water (or other ionizing solvent) solvation usually takes place. Liquids other than water can be used to form solutions, *e.g.* a solution of sulphur can be made in carbon disulphide (CS_2) or in methyl benzene (toluene) (C_7H_8) □ *aqueous solution; dilute solution; alcoholic solution; concentrated solution; saturated solution* ↓ SOLVENT · STANDARD SOLUTION · CONCENTRATE[2] · SOLUBLE · MOLAR[1]

DD002 solvent (*n.*) That part of a solution which is present in greater bulk. For the usual solutions considered this is the liquid part in which the solid is dissolved. In a solu-

tion of sodium chloride the solvent is water. When solutions are made with solvents other than water the solvent is usually specified □ *aqueous solvent; non-aqueous solvent* ↓ SOLUTE · CONCENTRATION · DILUTION[1] · DILUENT ↑ SOLUTION

DD003 protophilic solvent (*n.*) A solvent which accepts protons, *e.g.* water is a protophilic solvent. When hydrogen chloride gas is dissolved in water the water molecules accept hydrogen ions (protons) to form the hydroxonium ion (H_3O^+) ↑ SOLVENT

DD004 protogenic solvent (*n.*) Solvents which are donors of protons, *e.g.* liquid hydrogen fluoride and liquid hydrogen chloride are protogenic solvents. If pure nitric (V) acid HNO_3 is dissolved in liquid HF the ion $H_2NO_3^+$ is formed by addition of a proton. ↑ SOLVENT

DD005 aprotic solvent (*n.*) A solvent which will not accept protons, *e.g.* methyl benzene (toluene) is an aprotic solvent. If hydrogen chloride is dissolved in methyl benzene, no acid properties are shown. ↑ SOLVENT

DD006 solute (*n.*) The substance, solid or gas, which dissolves in the solvent to form a solution, *e.g.* ***a*** in a solution of sodium chloride in water, the water is the solvent and the sodium chloride is the solute; ***b*** with naphthalene as solute and ethanol as solvent a solution of naphthalene can be made; ***c*** a solution containing sulphur as solute may be made with carbon disulphide or methyl benzene (toluene) as solvent. ↑ SOLVENT

DD007 concentration (*n.*) **1** The process of concentrating. **2** The concentration of a solution giving information about the proportion of solute in the solution. It can be stated in a number of ways, ***a*** in grammes of solute per litre of solution (g dm^{-3}); ***b*** as a normality; ***c*** as a molarity; ***d*** as a percentage, *e.g.* a solution containing 4 g of NaOH in 100 cm^3 of water has a concentration of ***a*** 40 g dm^{-3}; ***b*** 1 N; ***c*** 1 M; ***d*** 4% by weight. —CONCENTRATE (*n.*) CONCENTRATED (*adj.*) CONCENTRATE (*v.*) ↓ DILUTION[1] (Cn) ↑ SOLVENT

DD008 molar concentration (*n.*) This usage is only acceptable if it means the concentration divided by amount of substance. The term is better avoided. A concentration can be stated in terms of g dm^{-3} or mol dm^{-3} or in terms of M. ↑ SOLVENT ↓ STANDARD SOLUTION

DD009 molal concentration (*n.*) The number of moles of solute in one kilogramme of solvent. ↑ SOLVENT ↓ STANDARD SOLUTION

DD010 dilution[1] (*n.*) **1** The process of adding a diluent, *e.g.* the dilution of a concentrated acid with water (the diluent). **2** The volume in litres of a solution which would contain 1 mole of the chemical species, *e.g.* a solution of sodium chloride which contains 5·85 g dm^{-3} has a dilution of 10. ↑ CONCENTRATION (Cn) · SOLVENT

DD011 diluent (*n.*) A substance added to another substance in the same state to reduce the concentration of the latter. Water may be added to an acid as a diluent. Starch may be added to substances in a pill or tablet. Nitrogen in the air acts as a diluent for the oxygen. —DILUTION[1] (*n.*) DILUTE[1] (*v.*) DILUTE[2] (*adj.*) ↑ SOLVENT

DD012 standard solution (*n.*) A solution of known concentration. The concentration may be stated in grammes per cubic decimetre g dm^{-3}, or as molarity, or normality. The molarity of a solution is obtained by dividing the mass of solid present in 1 dm^3 of solution by the mass of 1 mole of the solid, *i.e.* formula weight. ↓ MOLE[2] · GRAMME MOLECULE · EQUIVALENT WEIGHT · MOLAR VOLUME · GRAMME MOLECULAR VOLUME ↑ SOLUTION → VOLUMETRIC ANALYSIS

DD013 mole[2] (*n.*) The mole is one of the quantities used for measuring matter. The amount of matter can be measured in terms of the number of entities (atoms, molecules, ions, electrons). An amount of matter containing $6{\cdot}02 \times 10^{23}$ entities (atoms, molecules, ions, etc.) is called a mole. The entity should be stated. If not stated it may be assumed to be atoms for elements, molecules for covalent compounds, or lattice units for ionic compounds or covalent giant molecule structures. —MOLAR (*adj.*) ↑ STANDARD SOLUTION → MASS

DD014 gramme molecule (*n.*) The molecular weight of a compound stated in grammes. It is now obsolete, being replaced by the **mole**. ↑ STANDARD SOLUTION

DD015 equivalent weight (*n.*) The mass of an element which will combine with or displace directly or indirectly 1 g of hydrogen. The equivalent weight of an acid is the mass of acid which provides 1 g of hydrogen ions in solution. The equivalent weight of an alkali is the mass of alkali which will neutralize 1 g of hydrogen ions in solution. ↑ STANDARD SOLUTION

DD016 molar volume (*n.*) The volume occupied by 1 mole of a substance in a named state. For gases at s.t.p. this is always 22·4 dm^3. The symbol is V_m and the units are m^3 mol^{-1}. ↑ STANDARD SOLUTION

DD017 gramme molecular volume (*n.*) The volume occupied by one gramme molecule of a substance. It is an obsolete term replaced by **molar volume**. ↑ STANDARD SOLUTION

DD018 molarity (*n.*) The number of moles of solute in one cubic decimetre of solution, *e.g.* the molarity of a solution of H_2SO_4 containing 9·8 g dm^{-3} is 0·1 because the solution contains 0·1 mol dm^{-3}. ↑ STANDARD SOLUTION → VOLUMETRIC ANALYSIS

DD019 molality (*n.*) The concentration of a solution given in terms of the number of moles of solute dissolved in one kilogramme of solvent. ↑ STANDARD SOLUTION

DD020 M-value A method of labelling solutions to indicate their concentration in moles per cubic decimetre (mol dm^{-3}), *e.g.* a solution of sulphuric acid which contains 98 g dm^{-3} of H_2SO_4 is a 1 M solution ↑ STANDARD SOLUTION

DD021 normality (*n.*) A method of stating concentration in terms of the fraction of the equivalent weight of the compound in one litre (dm^3) of solution, *e.g.* the concentration of a solution containing 49 g (the equivalent weight) in 1 litre (dm^3) of solution is 1 N (normal); its normality is 1. The term has been replaced in many cases by **molarity**. ↑ STANDARD SOLUTION

DD022 water (*n.*) A general name for the liquid which has the molecular formula H_2O. There may be small quantities of dissolved solids and gases, or the liquid may be pure. ↓ HARD WATER · SOFT WATER · WATER SOFTENING ↑ SOLUTION

DD023 hard water (*n.*) Water which does not readily lather with soap. Such water contains cations (Ca^{2+} and Mg^{2+}) which form insoluble salts with the anions of the soap. Hardness may be either temporary and able to be removed by boiling, or permanent, when it can be removed by special water softening methods. ↑ WATER

DD024 soft water (*n.*) Water which contains no hardness, or has had all the hardness removed. ↑ WATER

DD025 water softening (*n.*) The process by which hardness is removed from hard waters. **Temporary hardness** is removed by boiling. **Total hardness** is removed by sodium carbonate, by detergents and by natural or artificial zeolite, and by sodium hexametaphosphate. ↑ WATER

DD026 concentrate[2] (*v.t.*) **1** To remove solvent from a solution so that the proportion of solute to solvent is increased. This is usually done by evaporation of the solvent. **2** To increase the concentration of, *e.g.* to increase the proportion of a required constituent in an ore. —CONCENTRATION, CONCENTRATE[1] (*n.*) CONCENTRATED (*adj.*) ↓ DILUTE[1] (I) · DEIONIZE ↑ SOLUTION

DD027 dilute[1] (*v.t.*) To add more solvent to a solution to reduce the concentration of the solute, *i.e.* to increase the proportion of solvent to solute in the solution □ *a solution is diluted with water* —DILUTION, DILUENT (*n.*) DILUTE (*adj.*) ↑ CONCENTRATE[2] (Cn)

DD028 deionize (*v.t.*) To remove ions from a solution. Water softeners partially deionize by removing calcium and magnesium ions. Some special resins are made to remove all ions, producing deionized water. —***deionized*** (*adj.*) ↑ CONCENTRATE[2] → WATER SOFTENING

DD029 soluble (*n.*) Describes a solid or gas which under suitable conditions will dissolve in a named liquid. If no liquid is mentioned then water is assumed to be the solvent. ↓ INSOLUBLE (I) · CONCENTRATED · DILUTE[2] · NEUTRAL[1] · AQUEOUS · SATURATED[1] ↑ SOLUTION

DD030 insoluble (*adj.*) Describes a substance which does not dissolve in a named solvent. The solvent is usually taken to be water. The term is in contrast to **soluble** and **sparingly soluble**, *e.g.* sulphur dioxide is soluble (80 cm^3 in 1 cm^3 water); hydrogen sulphide is sparingly soluble (5 cm^3 in 1 cm^3 water); hydrogen is insoluble (0·02 cm^3 in 1 cm^3 water). Insoluble is a relative term. For all practical purposes, hydrogen is insoluble in water, *e.g.* it can be collected over water. The term can be similarly applied to solids and their solvents. Both barium sulphate and calcium sulphate are said to be insoluble because they are precipitated from solutions of their ions; the solubilities at room temperature in 100 g of water are: barium sulphate $2{\cdot}0 \times 10^{-4}$ g; calcium sulphate $2{\cdot}4 \times 10^{-4}$ g. Although calcium sulphate is considered for all practical purposes to be insoluble in water, sufficient dissolves to give permanent hardness to water. ↑ SOLUBLE (Ag)

DD031 concentrated (*adj.*) Describing a solution containing a high proportion of solute □ *a concentrated acid is usually corrosive; a very concentrated solution of ammonium chloride* —CONCENTRATE, CONCENTRATION (*n.*) CONCENTRATE (*v.*) ↑ SOLUBLE → STRONG ELECTROLYTE

DD032 dilute[2] (*adj.*) Describes a solution in which the solvent is in large excess over the solute □ *a very dilute solution of sodium chloride* —DILUTION, DILUENT (*n.*) DILUTE[1] (*v.*) ↑ SOLUBLE · CONCENTRATED (Ag) → WEAK ELECTROLYTE

DD033 neutral[1] (*adj.*) Describes a solution which shows neither acid nor alkaline reactions with a suitable indicator. Such a solution has pH 7 (that of pure water). —NEUTRALIZATION (*n.*) NEUTRALIZE (*v.*) ↑ SOLUBLE → ACID · BASE[3] · pH · ACIDIC (Cm) · ALKALINE (Cm)

DD034 aqueous (*adj.*) Describes a solution made with water as solvent, *e.g.* ***a*** aqueous ammonia is ammonia gas dissolved in water; ***b*** an aqueous solution of potassium hydroxide $KOH_{(aq)}$ may be compared with an alcoholic solution of potassium hydroxide (ethanolic potash) $KOH_{(alc)}$. ↑ SOLUBLE

DD035 saturated[1] (*adj.*) Describes a solution containing the maximum possible amount of solute in a specified amount of solvent at a given temperature. If a solution is saturated, no more solute can be dissolved. ↑ SOLUBLE

DD036 molar[1] (*adj.*) Correctly used this means divided by the amount of substance. It is however often loosely used for statements of concentration in moles per litre. The use of M for showing concentration can be taken as:

$$\frac{\text{mass of substance in 1 dm}^3}{\text{mass of 1 mole of substance}}, \text{ thus}$$

$$0{\cdot}5\ \text{M}\ H_2SO_4 = \frac{49\ \text{g}\ (H_2SO_4\ \text{in 1 dm}^3)}{98\ \text{g (Mass of 1 mole of } H_2SO_4 \text{ molecules).}}$$

↓ EQUIVALENT (*adj.*) ↑ SOLUTION

DD037 equivalent (*adj.*) Having a similar or identical effect to. In chemistry, amounts of substances are said to be equivalent when they react together exactly, or when they each react with a certain quantity of a third

substance. Thus, ***a*** in neutralization of an acid by a base the masses of acid and base are equivalent if they react to give a neutral solution; ***b*** 32·5 g of zinc will displace 31·5 g of copper; the two quantities are equivalent; ***c*** 12 g of magnesium will displace 1 g of hydrogen from an acid; this amount is equivalent to 1 g of hydrogen; ***d*** 31·6 g of $KMnO_4$ is equivalent to 56 g of Fe^{2+} in oxidation. ↑ MOLAR[1]

DD038 colligative properties (*n.*) Properties of non-volatile solutes which depend for their value on the total of solute particles in a given amount of solvent. Such properties include vapour pressure, boiling point, freezing point, and osmotic pressure of solutions containing non-volatile solutes. ↓ RAOULT'S LAW[1] · HENRY'S LAW ↑ SOLUTION

DD039 Raoult's law[1] (*n.*) The relative lowering of the vapour pressure of a solution containing a non-volatile solute is equal to the mole fraction of the solute in solution. The law applies to colligative properties. Many solutions diverge from Raoult's Law, therefore the law may be looked upon as a definition of an ideal solution. ↑ COLLIGATIVE PROPERTIES

DD040 Henry's law (*n.*) The mass of a gas dissolved by a given volume of liquid at a constant temperature is proportional to the pressure of the gas. The law does not hold if there is any reaction between the gas and the solvent, *e.g.* ammonia and sulphur dioxide are very soluble gases and do not obey the law. ↑ COLLIGATIVE PROPERTIES

DD041 azeotropic mixture (*n.*) A mixture of liquids which boils with a constant boiling point. Such a boiling point may be above or below the boiling points of the constituents. At such a constant boiling point the composition of liquid and vapour are equal. The composition of azeotropic mixtures varies with pressure. —***azeotrope*** (*n.*) ↑ SOLUTION → DISTILLATION

DD042 suspension (*n.*) Fine particles of an insoluble substance uniformly dispersed throughout a liquid or gas, *e.g.* ***a*** when calcium hydroxide in powder form is shaken with water, a suspension of calcium hydroxide in water is formed; ***b*** milk consists of a suspension of fat particles in a liquid (a colloidal solution); ***c*** smoke is a suspension of solid particles in air. —***suspend*** (*v.*) ***suspended*** (*adj.*) ↓ PRECIPITATE[1] · PRECIPITATE[2] · PRECIPITATED · FLOCCULENT → ATOMIC STRUCTURE

DD043 precipitate[1] (*n.*) An insoluble substance obtained when certain solutions are mixed. When a solution of silver nitrate is added to a solution of sodium chloride a white insoluble solid appears, which is silver chloride □ *a precipitate is formed* —PRECIPITATION, PRECIPITANT (*n.*) PRECIPITATE[2] (*v.*) PRECIPITATED (*adj.*) ↓ PRECIPITANT ↑ SUSPENSION

DD044 precipitant (*n.*) A substance added to a solution to cause a precipitate to appear. It may cause the dissolved substance to come out of solution, or it may form a new, insoluble substance, *e.g.* ***a*** the addition of $HCl_{(aq)}$ to an aqueous solution of a weak solid organic acid will cause that acid to be precipitated out as a solid; ***b*** silver nitrate solution added to a solution of sodium chloride produces the formation of insoluble silver chloride by reaction of Ag^+ and Cl^-. ↑ PRECIPITATE[1]

DD045 precipitate[2] (*v.t.*) To add a precipitant to a solution in order to produce a precipitate. Silver chloride is precipitated by adding silver nitrate solution to a solution of sodium chloride. ↑ SUSPENSION

DD046 precipitated (*adj.*) In a very fine powder, as when formed as a precipitate, *e.g.* precipitated calcium carbonate as distinct from lumps or coarse powder. ↓ MILKY ↑ SUSPENSION

DD047 milky (*adj.*) Describing a liquid containing a white precipitate just heavy enough to give the appearance of milk. The term is usually applied to the appearance of calcium hydroxide solution (lime water) when carbon dioxide is passed into it □ *a solution of* $Ca(OH)_2$ *turns milky* —***milkness*** (*n.*) ↑ PRECIPITATED

DD048 flocculent (*adj.*) Describes a precipitate which collects together in small clusters like little light masses of wool. The precipitate formed by sodium chloride solution and silver nitrate solution, namely silver chloride, is flocculent. —***flocculate*** (*v.*) FLOCCULATION (*n.*) ↓ HEAVY ↑ SUSPENSION

DD049 heavy (*adj.*) Describes a precipitate which forms in great quantity and settles quickly. A precipitate of barium sulphate is a heavy precipitate. In contrast a precipitate of calcium sulphate is a light precipitate. ↑ FLOCCULENT → LIGHT (An)

DD050 solvation (*n.*) The process in which molecules of solvent are attached to ions or molecules of solute in solution. —***solvate*** (*v.*) SOLVATED (*adj.*) ↓ HYDRATION ↑ SOLUTION → SOLVATION ENERGY · COMPLEX ION · AQUA-ION

DD051 hydration (*n.*) A special type of solvation when the solvent is water. The water molecules may be attached to an ion by, ***a*** electrostatic forces; ***b*** by dative covalent bonds. Some ions retain associated water molecules in the solid state, *e.g.* in solid copper (II) sulphate crystals the ion is $[Cu(H_2O)_4]^{2+}$. —HYDRATE (*n.*) ***hydrate*** DEHYDRATE (*v.*) HYDRATED[3] (*adj.*) ↑ SOLVATION → DEHYDRATION · SALT · ANHYDROUS (I)

DD052 adduct (*n.*) A molecule combined with a salt when that molecule is one of a solvent. It is most usually H_2O but the adduct can be C_2H_5OH (ethanol), NH_3 (ammonia) – the latter more usually in the gaseous state unless liquid ammonia is used as an ionizing solvent, *e.g.* $CaCl_2.2NH_3$. ↓ HYDRATE ↑ SOLVATION

DD053 hydrate (*n.*) A solid salt which contains water molecules in its molecules as water of crystallization. Copper (II) sulphate crystals contain five molecules of

water of crystallization in each unit. Traditionally this was called 'copper sulphate pentahydrate'. Some chemical manufacturers now call this copper (II) sulphate – 5 – water. When the structure of the crystal is known (as in copper (II) sulphate – 5–water) it can be written: tetraquo copper (II) sulphate (VI) – 1 – water. —HYDRATED[1] (*adj.*) ↑ ADDUCT (H)

DD054 solvated (*adj.*) Describes molecules or ions which have molecules of solvent attached either by coordinate bonds, by hydrogen bonds, or by electrostatic forces. The hydrogen ion can only exist in solution in the solvated state; the solvent molecules are usually H_2O. Solvated hydrogen ions are often formally shown as H_3O^+ but more correctly as $H_9O_4^+$, where the bonding is hydrogen bonding. A simpler way to write it is $H^+_{(aq)}$ (H^+ in solution in water). The corresponding ion in liquid ammonia is $(NH_4)^+$. ↓ HYDRATED[3] (H) ↑ SOLVATION → ANHYDROUS

DD055 hydrated[3] (*adj.*) Having water molecules attached to the ions either by coordinate bonding, hydrogen bonding, or in many cases in solutions of ionic crystals in water, by electrostatic forces □ *an hydrated ion; copper (II) sulphate –5 –water is an hydrated salt* —HYDRATE, HYDRATION (*n.*) ↑ SOLVATED (H) → ANHYDROUS (I)

Colloids

DE001 disperse systems (*n.*) A system which consists of two phases, one of which is distributed throughout the other. The distributed substance is called the disperse phase and the continuous phase is called the dispersion medium, *e.g.* ***a*** smoke is a disperse system with a gas as the continuous phase (dispersion medium) and a solid as the disperse phase; milk is a disperse system with solid as the disperse phase and a liquid as the dispersion medium. ↓ DISPERSION MEDIUM · PHASE[3] · FOAM · STABILIZE[2] · DISPERSED · COLLOIDAL SYSTEMS → ATOMIC STRUCTURE

DE002 dispersion medium (*n.*) The continuous phase in a disperse system, *e.g.* in an aluminium hydroxide sol the disperse phase is aluminium hydroxide and the dispersion medium is water. ↓ DISPERSE PHASE · EMULSION · EMULSIFYING AGENT · WETTING AGENT · SOAP[1]

DE003 disperse phase (*n.*) The discontinuous phase in a disperse system, consisting of particles distributed throughout the continuous phase (*i.e.* the dispersion medium). ↑ DISPERSION MEDIUM → DISCONTINUOUS

DE004 emulsion (*n.*) A two-phase disperse system in which both phases are liquid. If the dispersion medium is water and the disperse phase is oil, the system is an oil in water emulsion. —***emulsify*** (*v.*) ***emulsified*** (*adj.*) ↑ DISPERSION MEDIUM

DE005 emulsifying agent (*n.*) An oil/water emulsion behaves like a hydrophobic sol. An emulsifying agent is a substance added to a system to stabilize the emulsion, *e.g.* soap can be used as an emulsifying agent in an oil/water system. ↑ DISPERSION MEDIUM → HYDROPHOBIC

DE006 wetting agent (*n.*) A surface agent which lowers the surface tension of water. This allows the water to spread out on a surface. The molecules of such compounds contain a water attracting part and an oil attracting part. ↑ DISPERSION MEDIUM → SURFACE TENSION

DE007 soap[1] (*n.*) A sodium or potassium salt of a fatty acid with a long carbon chain. Sodium stearate $C_{17}H_{35}COONa$ is a common example. The sodium salts are hard soaps. The potassium salts are soft soaps. Soaps are surface acting agents. ↑ DISPERSION MEDIUM → SURFACE ACTING AGENT

DE008 phase[3] (*n.*) A part of a system which is marked off from other parts of the system by a boundary at which there is an abrupt change of physical properties, *e.g.* ***a*** ice, water and steam are separate phases; ***b*** at the transition point where they can exist in equilibrium, rhombic and monoclinic sulphur are two phases. ↓ PHASE RATIO ↑ DISPERSE SYSTEMS

DE009 phase ratio (*n.*) The ratio of the mass of the disperse phase to the mass of the dispersion medium, expressed as a percentage. ↑ PHASE[3]

DE010 foam (*n.*) A large number of small bubbles of gas, each bubble enclosed in a thin film of liquid. It may form on the surface of a liquid in which small bubbles of gas are being formed rapidly. It is also formed when a gas and liquid are forced through a nozzle together under pressure, as in carbon dioxide foam. —***foam*** (*v.*) ***foaming*** (*adj.*) ↓ FROTH · SMOKE ↑ DISPERSE SYSTEMS

DE011 froth (*n.*) A system similar to foam, but less stable. Froth is formed in some chemical preparations, *e.g.* ***a*** when distilling the fermented liquor during the preparation of ethanol; ***b*** during the preparation of chloroform. —FROTH (*v.*) ***frothing*** (*n.*) ↑ FOAM

DE012 smoke (*n.*) Small solid particles dispersed in a gas. When ammonia gas and hydrogen chloride gas are mixed, a white smoke is formed of particles of solid ammonium chloride dispersed in air. ↑ FOAM

DF013 stabilize[2] (*v.t.*) To render stable or prevent from changing, *e.g.* lyophilic sols can be stabilized by the addition of small amounts of certain substances. Gelatin is often used as a stabilizer for hydrophilic

sols. —STABILIZER (*n.*) STABLE (*adj.*) ↓ LYOPHILIC ↑ DISPERSE SYSTEMS

DE014 atomize (*v.t.*) To convert a liquid into a very fine spray. This is usually done by hand pressure on a flexible container or in a strong container under pressure with an inert gas. The result is a disperse system in which air or the inert gas forms the dispersion medium, and the liquid the disperse phase. ↑ STABILIZE[2]

DE015 dispersed (*adj.*) Describes a substance that is spread in small particles through a liquid or gas. The result is a dispersion or disperse system; the particles are dispersed. —DISPERSION (*n.*) DISPERSE (*v.*) DISPERSE (*adj.*) ↑ DISPERSE SYSTEMS

DE016 colloidal systems (*n.*) **1** Dispersions in the colloidal state in which the colloidal particles are dispersed in a continuous phase (the dispersion medium) of a different composition or state. **2** True solutions of materials of which the dimensions are within the colloidal range (1 nm to 10^2 nm), *e.g.* molecules of very large relative molecular mass such as polymers and proteins, or aggregates of small molecules, as in soaps and detergents under certain conditions (association colloids). ↓ COLLOID · SOL · GEL · LYOPHILIC · CATAPHORESIS · COAGULATE[1] ↑ DISPERSE SYSTEMS

DE017 colloid (*n.*) A component of a colloidal system. ↓ COLLOIDAL STATE · ASSOCIATION COLLOID ↑ COLLOIDAL SYSTEMS

DE018 colloidal state (*n.*) A disperse system is said to be in the colloidal state when one or more of its components have at least one dimension between 1 nm to 10^2 nm. ↑ COLLOID

DE019 association colloid (*n.*) A colloidal system containing aggregates of small molecules formed under certain conditions in soap or detergent solutions. ↑ COLLOID

DE020 sol (*n.*) Any colloidal system in which the dispersion medium is a liquid. Sols are of two kinds, **lyophobic** and **lyophilic**. The terms also used are ***suspensoid*** and ***emulsoid***. ↓ SUSPENSOID · EMULSOID HYDROSOL ↑ COLLOIDAL SYSTEMS

DE021 suspensoid (*n.*) The term sometimes used for a sol when the disperse phase is a solid. ↑ SOL · SUSPENSION

DE022 emulsoid (*n.*) The term sometimes used for a sol when the disperse phase is a liquid. ↑ SOL

DE023 hydrosol (*n.*) A sol in which water is the dispersion medium, *e.g.* a gold hydrosol in which gold particles are the disperse phase and water is the dispersion medium. ↑ SOL

DE024 gel (*n.*) An intermediate stage in the coagulation of a sol. A mass of intertwining filaments enclose the whole of the dispersion medium to produce a pseudo-solid. A gel is jelly-like in appearance and forms a distortable mass. —GELATION (*n.*) GEL (*v.*) ↓ REVERSIBLE GEL · HYDROGEL · ALCOGEL · GELATION ↑ COLLOIDAL SYSTEMS · SOL (Sn) · GEL (Sn)

DE025 reversible gel (*n.*) A gel which can be converted into a sol. Gelatin gel is a reversible gel because it can be changed back to a sol by heat. Silica gel cannot be converted into a sol by any simple process. ↑ GEL

DE026 hydrogel (*n.*) A gel in which the dispersion medium is water. ↑ GEL

DE027 alcogel (*n.*) A gel in which the dispersion medium is ethanol. ↑ GEL

DE028 gelation (*n.*) Many substances which form lyophilic sols can be obtained in a jelly-like condition. The process is called gelation, *e.g.* gelatin mixed with water forms a colloidal solution; when cooled this becomes a semi-solid. —GEL (*n.*) ***gel*** (*v.*) ↑ GEL

DE029 lyophilic (*adj.*) Solvent attracting. Lyophilic sols are sols in which the disperse phase has an attraction for the continuous phase, *e.g.* egg albumin, starch, and association colloids. ↓ LYOPHOBIC (I) · HYDROPHILIC (H) · HYDROPHOBIC ↑ COLLOIDAL SYSTEMS

DE030 lyophobic (*adj.*) Solvent repelling. Lyophobic sols are sols in which the disperse phase has no attraction for the continuous phase, *e.g.* gold sol and sulphur sol. ↓ HYDROPHOBIC (I) ↑ LYOPHILIC (I)

DE031 hydrophilic (*adj.*) An alternative term for LYOPHILIC, used when the continuous phase (dispersion medium) is water. ↓ HYDROPHOBIC (I) ↑ LYOPHILIC (H)

DE032 hydrophobic (*adj.*) An alternative term for LYOPHOBIC, used when the continuous phase (dispersion medium) is water. ↑ LYOPHILIC · HYDROPHILIC (I) · HYDROPHOBIC (H)

DE033 cataphoresis (*n.*) The movement of colloidal particles in an electric field. When two platinum electrodes connected to a d.c. supply are placed in a lyophobic sol, the colloidal particles will move either to cathode or anode depending on the charge on the particles. ↓ ELECTROPHORESIS · DIALYSIS · COAGULATION · HARDY-SCHULTZE RULE ↑ COLLOIDAL SYSTEMS

DE034 electrophoresis (*n.*) Alternative term for CATAPHORESIS.

DE035 dialysis (*n.*) A process for separating a sol from a true solution. It makes use of the marked difference in the rate of diffusion of colloidal particles and of the smaller solute molecules or ions. A membrane is used and the solute molecules pass rapidly through into the solvent. ↑ CATAPHORESIS

DE036 coagulation (*n.*) The process of coagulation or of causing something to coagulate, *e.g.* the coagulation of egg white is brought about by heat. —COAGULATE (*v.*) ↑ CATAPHORESIS

DE037 Hardy-Schultze rule (*n.*) For equal concentrations, the coagulating effect of an ion upon a disperse phase of opposite charge depends upon the valency of the ion causing the coagulation. The precipitating effect of monovalent divalent, and trivalent, ions is approximately in the ratio 1:70:600. ↑ CATAPHORESIS

DE038 coagulate[1] (*v.t.,i.*) **1** (*t.*) To cause

particles in a colloid to collect together in a compact mass, *e.g.* an arsenic sulphide sol can be coagulated by monovalent cations.

2 (*v.i.*) (Of particles) to collect together in a compact mass. —COAGULATION (*n.*) ↑ COAGULATE[1] · COLLOIDAL SYSTEMS

Ionic Theory

DF001 ionic theory (*n.*) A theory put forward by Arrhenius in 1887, to account for certain electrical phenomena associated with solutions. ↓ IONIZATION · COMPLEX ION · IONIC FORMULA · BUBBLE CHAMBER · IONIZE · IONIZED

DF002 ionization (*n.*) **1** The process by which a chemical species, *e.g.* an atom, molecule, etc., loses or gains an electron to form an ion. **2** The process whereby certain molecules break up into ions of opposite charge, *e.g.* an acid (HX) forms H^+ and X^- in solution □ *H_2SO_4 undergoes ionization in solution in water* —IONIZE (*v.*) IONIC, IONIZED (*adj.*) ↓ DEGREE OF IONIZATION · PERCENTAGE IONIZATION · ION ↑ IONIC THEORY → CONDUCTANCE[2] · POLAR SOLVENT · BUBBLE CHAMBER · DISCHARGE TUBE

DF003 degree of ionization (*n.*) The degree, expressed as a decimal fraction, to which a compound, etc., is ionized, *e.g.* the degree of ionization (α) of 0·1 M ethanoic (acetic) acid is 0·0134. ↑ IONIZATION

DF004 percentage ionization (*n.*) The amount of ionization expressed as a percentage. The percentage ionization is equal to the degree of ionization × 100. The degree of ionization of 0·1 M ethanoic acid (CH_3COOH) is 0·0134. Its percentage ionization is 1·34. ↑ IONIZATION → DISSOCIATION

DF005 ion (*n.*) Electrons may be removed from atoms, ***a*** by increasing their energy so that they escape from the attraction of the nucleus; ***b*** by the attracting power (electron affinity) of another atom which exceeds the attraction of the other nucleus; ***c*** the affect of one atom of high electronegativity on an atom of lower electronegativity in a covalent compound. In this case a shared pair is *captured* leaving one atom short of an electron. Atoms or groups of atoms which lose electrons or gain electrons by any of these methods become *ions*, *i.e.* atoms or groups of atoms which have lost or gained one or more electrons. Such ions are charged, the magnitude of the charge depending upon the number of electrons lost or gained. Electrons lost result in positive ions; electrons gained result in negative ions, *e.g.* in gases or vapours electrons may be energized to the point where they leave the atom ($H \rightarrow H^+$). This may be done, ***a*** by a very high potential difference in a discharge tube; ***b*** by ionizing radiation (gamma rays, etc.) from a radioactive source. In the reaction in the vapour state between sodium and chlorine, one electron leaves a sodium atom and goes to a chlorine atom forming Na^+ and Cl^-. In aqueous solution an acid (a covalent compound in the pure state) loses a hydrogen ion. This process is aided by the effect of water molecules. —IONIZATION (*n.*) IONIZE (*v.*) IONIZED, IONIC (*adj.*) ↑ IONIZATION → SOLVATION

DF006 complex ion (*n.*) Strictly, a complex ion is one which has been formed from more than one atom. This would apply to SO_4^{2-}, CO_3^{2-}, and so on. More usually the term is used for ions formed by coordination of ligands, *e.g.*

tetrammine copper (II) $[Cu(NH_3)_4]^{2+}$

hexacyanoferrate (III) $[Fe(CN)_6]^{3-}$

↓ COMPLEX CATION · COMPLEX ANION ↑ IONIC THEORY · ION → LIGAND

DF007 complex cation (*n.*) A complex ion carrying overall positive charge. The structure of the ion is such that it has as its centre an atom of a metallic element; it is most usually a transition element, *e.g.*:

tetraquo copper (II) $[Cu(H_2O)_4]^{2+}$

dichlorotetraquo chromium (III) $Cr[Cl_2(H_2O)_4]^+$ ↑ COMPLEX ION

DF008 complex anion (*n.*) A complex ion carrying overall negative charge. They usually have an atom of a metallic element as the central atom (most usually a transition element). The name of the ion ends in *-ate* followed by the appropriate oxidation number, *e.g.*:

tetrachloro cuprate (II) $[CuCl_4]^{2-}$

↑ COMPLEX ION

DF009 ionic formula (*n.*) The formula of an ionic compound written to show the individual ions present, *e.g.* barium sulphate, $Ba^{2+}SO_4^{2-}$ ↑ IONIC THEORY

DF010 bubble chamber (*n.*) A chamber containing a liquid, usually liquid hydrogen, at a temperature slightly above its boiling point. High energy charged particles cause the formation of ions which in turn provide centres for the development of bubbles. The paths of the particles are thus shown. ↑ IONIC THEORY → CLOUD CHAMBER

DF011 ionize (*v.t.,i.*) **1** (*v.t.*) To convert into ions. **2** (*v.i.*) (Of a compound or molecule) to change into ions. ↑ IONIC THEORY · IONIZE

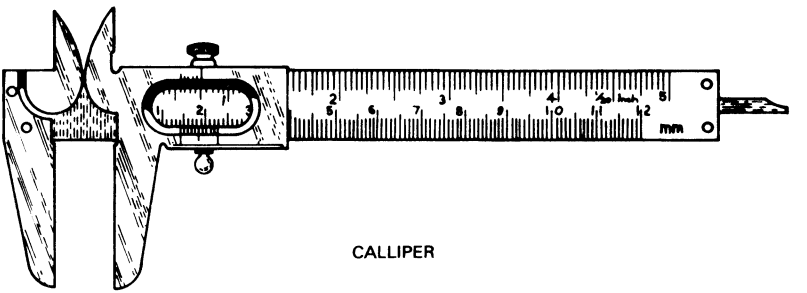
DF012 ionized (*adj.*) Changed into ions. An acid (a covalent compound) or a weak base (a covalent compound) is said to be ionized when the acid or base forms ions in solution in water, *e.g.* $H_2SO_{4(l)}$ is ionized in solution in water to form $2H^+$ and SO_4^{2-}; NH_4OH is ionized to form NH_4^+ and OH^-. ↑ IONIC THEORY → IONIC

Laws of Motion

EA001 motion (*n.*) If an object is observed at two different instants, and it is seen to be in two different positions at those two instants, then the object is in motion or has been in motion during the interval between the two observations, *e.g.* ***a*** the motion of the planets round the sun; ***b*** the motion of a stone falling under the force of gravity; ***c*** the motion of a motor car going along a road □ *a body in motion* ↓ PROTOTYPE · RULE[2] · VECTOR[2] · DISTANCE · RECTILINEAR → KINETICS

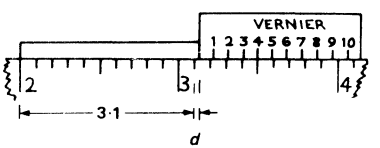
EA002 prototype (*n.*) The first or original model or pattern of anything from which copies can be made. The prototype kilogramme is the standard unit of mass. ↑ MOTION

EA003 rule[2] (*n.*) A device for measuring length or distance. Rules may be made in various materials according to their use. The common rule in a science laboratory is the metre stick. This is one metre long and is graduated in centimetres (cm) and millimetres (mm). The variant **ruler** is used to denote a shorter measuring stick, usually 1 foot long, graduated in inches and various fractions of an inch, and also in centimetres and millimetres. ↓ CALLIPER · VERNIER SCALE · MICROMETER SCREW GAUGE ↑ MOTION



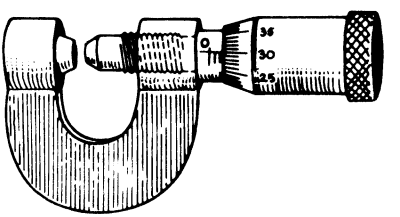
CALLIPER

EA004 calliper (*n.*) A device used to measure accurately the thickness, width, or diameter, of objects, both externally and internally. Callipers may use a vernier scale for greater accuracy. ↑ RULE[2]



VERNIER SCALE

EA005 vernier scale (*n.*) An additional scale which allows the measurement of fractions of a scale division on a number of measuring instruments. The vernier scale, which is the moving scale, has 10 divisions. These ten divisions correspond to 9 divisions on the fixed scale. A vernier division is shorter than a scale division by 0·1 of a scale division. The diagram shows a reading of 3·14. The second decimal place is given by the coincidence of 4 on the vernier scale with a division on the main scale. The vernier scale may be graduated in other ways depending on the units of the fixed scale. ↑ RULE[2]



MICROMETER SCREW GAUGE

EA006 micrometer screw gauge (*n.*) A device for the accurate measurement of small distances. A screw of constant pitch, made with great accuracy, passes through a screw tap in a metal collar. One turn of the screw moves the end of the screw one pitch. Attached to the collar is a scale marked in the required units. The screw itself has a hollow barrel which passes over the collar scale and is graduated in a suitable number of divisions – in this case one hundred. This allows 0·01 mm to be measured. ↑ RULE[2]

EA007 vector[2] (*n.*) Quantities which involve direction and magnitude, and must have both for a full description. They are also known as vector quantities. Examples of vector quantities are: displacement,

velocity, acceleration, force, magnetic fields and electric fields. Vector quantities can be represented graphically by a straight line; the direction of the line is the direction of the vector quantity and the length of the line is proportional to the magnitude of the vector. Vector quantities cannot be added arithmetically; they are added geometrically by the use of vector diagrams or by trigonometrical methods. Symbols for vector quantities are often printed in bold italic letters, *e.g.* ***F*** for a force. ↓ SCALAR · RESULTANT[1] ↑ MOTION

EA008 scalar (*n.*) A physical quantity which requires only a number and a unit for its specification. Examples of scalars are volume, quantity of energy, quantity of electricity, mass, and temperature. ↑ VECTOR[2]

EA009 resultant[1] (*n.*) The sum of a number of vectors, determined by using the polygon of vectors. Common examples are resultant force and resultant velocity; force and velocity are vector quantities. The triangle of forces or velocities is a common method of determining the resultant of two forces or two velocities. The resultant of a system of vectors has the same effect on a body as the system itself. ↑ VECTOR[2]

EA010 distance (*n.*) An interval in space; the distance travelled by a point or a body is the length of the track along which it has moved in a stated time. The track is not necessarily a straight line and the direction of a straight line is not necessarily stated. Distance is a scalar quantity. The distance between two points may be measured by the shortest interval of space between them or, if the points are on a track which is not straight, the length of the track. The distance between A and B may be 30 miles. Measured by road it may be 40 miles, *i.e.* the distance by road is 40 miles □ *the distance between two points* ↓ DISPLACEMENT[1] (H) ↑ MOTION → SCALAR

EA011 displacement[1] (*n.*) The distance moved or measured in a specified direction. The body or point moves in a straight line as the direction is stated. Displacement is a vector quantity. The symbol for displacement is *s*. The unit of measurement is the metre. Note: displacement is often called *distance* in elementary textbooks. —***displaced*** (*adj.*) ↓ DISTANCE → VECTOR

EA012 track[2] (*n.*) The visible or invisible line in space left behind by a point or body in motion, *e.g.* ***a*** the track of charged particles can be seen in cloud chamber experiments; ***b*** the track of a satellite in space. —***tracking*** (*n.*) ***track*** (*v.*) ↑ DISTANCE → PATH (Sn)

EA013 rectilinear (*adj.*) Describing motion or movement in a straight line □ *rectilinear motion is motion in a straight line; the rectilinear progagation of light* ↓ CIRCULAR ↑ MOTION

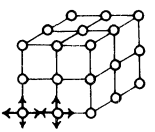
EA014 circular (*adj.*) Following a path which is a circle, or having a shape a section of which is a circle, *e.g.* ***a*** circular motion; ***b*** the horizontal section of a drinking glass is circular, *i.e.* it has a circular cross-section. ↑ RECTILINEAR

TRANSLATIONAL

EA015 translational (*adj.*) Describes motion which takes a particle from one place to another. The molecules of a gas and the particles in a liquid to a lesser extent undergo translational movement. ↑ RECTILINEAR

ROTATIONAL

EA016 rotational (*adj.*) Describes motion of a particle which rotates about an axis. Particles in liquids and gases are capable of rotational motion. ↑ RECTILINEAR



VIBRATIONAL

EA017 vibrational (*adj.*) Describes a motion which vibrates about a point. Such motion is the only motion possible in solids. ↑ RECTILINEAR

EA018 kinematics (*n.*) The study of the change in position of points in three-dimensional space during a specified time. Motion is described quantitatively in kinematics. No reference is made in kinematics to the cause of motion of actual bodies, that is, no reference is made to the forces acting on a body, or to the mass of a body, or to the dimensions of the body. The body is considered to be a point in space Kinematics is concerned with equations of motion, which relate distance, time, velocity, and acceleration. ↓ KINETICS[2] ↑ MOTION

EA019 kinetics[2] (*n.sing.*) An alternative term for DYNAMICS (→). → REST[2]

EA020 speed (*n.*) The rate of change of distance with time. An average speed is measured by the total distance travelled by a body divided by the total time taken to travel the distance. The track is not necessarily a straight line and the direction of the track is not stated when speed is measured. ↓ VELOCITY · ACCELERATION · DECELERATION · RETARDATION[1] ↑ KINEMATICS

EA021 velocity (*n.*) The rate of change of displacement with time; the rate of change of distance moved with time in a specified direction. Velocity is a vector quantity. The symbol for the quantity, velocity, is *u* or *v*. The unit of measurement is metres per second (m s^{-1}). Note that a body travelling along a curved track will have a uniform speed, if equal distances are travelled in the same period of time, but the velocity of the body will be continuously changing as the direction of motion is continuously changing □ *the magnitude of the velocity is 20 m* s^{-1} ↑ SPEED

EA022 initial velocity (*n.*) The velocity of a point or body when first considered, *i.e.* its velocity at the start of its displacement. The symbol for initial velocity is *u*. ↑ SPEED

EA023 average velocity (*n.*) Half the sum of the initial velocity and the final velocity:

$$\text{average velocity} = \frac{u + v}{2}$$

Average velocity is equal to displacement divided by time. A term used only with uniform acceleration. ↑ SPEED

EA024 instantaneous velocity (*n.*) The velocity of a body at a specified point in time:

$$u = \lim \frac{\delta s}{\delta t}$$

$$\text{AS } \delta t \rightarrow 0$$

EA025 final velocity (*n.*) The velocity of a point or body after a specified period of time from its first consideration, *i.e.* its velocity at the end of its displacement. The symbol for final velocity is *v*. ↑ SPEED

EA026 uniform velocity (*n.*) A velocity which does not change with time. ↑ SPEED

EA027 acceleration (*n.*) The rate of change of velocity with time. Acceleration is a vector quantity. Acceleration is considered positive if the velocity is increasing, and it is considered negative if the velocity is decreasing. The term acceleration is usually restricted to cases of increasing velocity. The symbol for acceleration is *a*. The unit of measurement is metres per second per second (m s^{-2}) □ *the magnitude of an acceleration is measured in m* s^{-2}*; a uniform acceleration* —***accelerate*** (*v.*) ***accelerated*** (*adj.*) ↓ DECELERATION (An) · RETARDATION[1] (An) ↑ SPEED

EA028 deceleration (*n.*) A negative acceleration; *i.e.* motion in which the body is moving with decreasing velocity. —***decelerate*** (*v.*) ↑ SPEED

EA029 retardation[1] (*n.*) This term is similar in meaning to deceleration but focus here is on the slowing down and the possible force producing the reduction in velocity. —***retard*** (*v.*) ***retarded, retarding*** (*adj.*) ↑ SPEED

EA030 equations of motion (*n.*) Equations which connect the velocity or speed, acceleration, time, and distance, for a body moving with uniform acceleration:

a $v = u + at$
b $s = ut + \frac{1}{2}at^2$
c $v^2 - u^2 = 2as$

v is the final velocity, *u* the initial velocity, *a* the acceleration, *t* the time, and *s* the distance. ↓ ANGULAR VELOCITY · ANGULAR ACCELERATION

EA031 angular velocity (*n.*) The rate of rotation of a body about an axis. It is stated in radians per second (rad s^{-1}). Angular velocity is a vector quantity which is equal to the linear velocity divided by the radius of the arc on which the body is moving. The symbol for angular velocity is ω (the Greek letter omega). ↑ EQUATIONS OF MOTION

EA032 angular acceleration (*n.*) The rate of increase of angular velocity measured in radians per second per second (rad s^{-2}). The symbol for angular acceleration is α (the Greek letter alpha). ↑ EQUATIONS OF MOTION

EA033 relative velocity (*n.*) If two particles A and B are moving in the same direction with velocities V_A and V_B, then the relative velocity of A to B is $V_A - V_B$. If they are moving in opposite directions then the relative velocity of A to B will be $V_A + V_B$. ↑ KINEMATICS

Forces

EB001 force (*n.*) A physical agent which changes or tends to change the state of motion of a mobile body, or to change the shape of a fixed body, *e.g.* ***a*** a force can cause a body, which is at rest, to move; ***b*** a force causes a body in motion to go faster, or to slow down, or to stop; ***c*** a force extends or compresses an elastic body; ***d*** a force deforms a plastic body. A force is defined as that which changes, or tends to change, a body's state of rest, or of uniform motion in a straight line. A force, *F*, acting on a body of mass *m* produces an acceleration, *a*, in the direction of the force, and $F = ma$. Force is measured in newtons, if mass is in kilogrammes, and acceleration is in metres per second^2, *i.e.* a force of 1 N gives a mass of 1 kg an acceleration of 1 m s^{-2} in the direction of the force □ *a body exerts a force when colliding; a force is applied at a point; a force acts in a stated direction* —***forced*** (*adj.*) ↓ CONSTRAINING FORCE · REST[2] · MOMENTUM · INERTIA · VEHICLE · CONSTRAIN · MOBILE[1] · GRAVIATION → PROJECTILE · RELATIVITY · FRICTION · VISCOSITY[1] · MOTION

EB002 constraining force (*n.*) A force which makes a body stay in a fixed position or in a particular state of motion, *e.g.* a force

which makes a body travel in a circular path is a constraining force. ↓ RESTORING FORCE · TENSION[1] · THRUST[1] · REACTION[1] · NORMAL REACTION · INTERACTION · RESISTANCE[1] ↑ FORCE

EB003 restoring force (*n.*) A force which returns, or tends to return, a body to its former position or to its former shape, *e.g.* ***a*** when a pendulum reaches its highest point of swing, a restoring force returns it to its position of rest; ***b*** when a spring is extended by a force, a restoring force subsequently returns the spring to its original length. ↑ CONSTRAINING FORCE

EB004 tension[1] (*n.*) **1** A force tending to stretch a string, rope, wire, spring, rod, or bar, is the tension acting on the string, etc. It is a force which pulls. When a body is supported by a string tied to a hook, the weight of the body produces a tension in the string; the tension in the string is equal and opposite to the weight of the body, so the body is at rest. The tension in the string is equal and opposite to the reaction of the hook, so the hook is at rest. The string, if elastic, will be stretched. **2** The condition in a string, or other body, when it is acted upon by a stretching force; the body is said to be *under tension.* —TENSE, ***tensile*** (*adj.*) ↓ THRUST (An) ↑ CONSTRAINING FORCE

EB005 thrust (*n.*) **1** A force tending to compress a spring, rod, or bar. It is a similar force to tension but acts in the opposite direction. **2** The condition in a compressed spring, rod or bar, when it is acted upon by a compressing force. **3** A force of propulsion, *e.g.* the thrust delivered by the propellor of a ship. —***thrust*** (*v.*) ↑ CONSTRAINING FORCE · TENSION[1] (An)

EB006 reaction[1] (*n.*) When an external force acts on a body, an equal and opposite force is produced in the body; this is a reaction, *e.g.* ***a*** when a book is put on a table, the reaction of the table is equal and opposite to the weight of the book; ***b*** when a projectile hits a body at rest, the reaction of the body is equal and opposite to the action of the projectile on the body. ↑ CONSTRAINING FORCE

EB007 normal reaction (*n.*) If a reaction is at right angles to a surface, it is a normal reaction. ↑ CONSTRAINING FORCE

EB008 interaction (*n.*) The mutual action of two forces on each other, *e.g.* ***a*** when a weight extends a spring, there is an interaction between the weight and the spring; when a weight is placed on a fixed, rigid surface, there is an interaction between the action of the gravitational force of the weight downwards and the reaction of the surface upwards. —***interact*** (*v.*) ↑ CONSTRAINING FORCE

EB009 resistance[1] (*n.*) Opposition to a force, preventing movement; the opposition can be active or passive, *e.g.* ***a*** frictional resistance prevents one body sliding over another; ***b*** the resistance of the air slows down a falling body. —***resistant*** (*n.*) ↑ CONSTRAINING FORCE

EB010 rest[2] (*n.*) A state of no motion in relation to an observer, *i.e.* a body at rest remains at the same distance from the observer. For normal experimental conditions, a body at rest does not move from its position in relation to the Earth, *e.g.* a table is at rest on the floor of a house. ↓ NEWTON'S LAWS OF MOTION · NEWTON'S FIRST LAW · NEWTON'S SECOND LAW · NEWTON'S THIRD LAW · MECHANICS · DYNAMICS · KINETICS[1] · NEWTONIAN MECHANICS ↑ FORCE

EB011 Newton's laws of motion (*n.*) These are stated as three principles relating the effects of force, mass, and motion, with respect to a body. They are the basis of Newtonian mechanics. ↑ REST[2]

EB012 Newton's first law (*n.*) The law that every body continues in its present state of rest, or uniform motion in a straight line, unless acted upon by an external force compelling it to change that state. ↑ REST[2]

EB013 Newton's second law (*n.*) The law that the rate of change of momentum of a body is proportional to the applied force and takes place in the direction of that force. The law can be written as the equation $F = ma$, where F is force, m is mass, and a is acceleration. ↑ REST[2]

EB014 Newton's third law (*n.*) The law that to every action there is an equal and opposite reaction, *e.g.* ***a*** when a book rests on a table, the weight of the book acts on the table, and there is an equal but opposite force exerted by the table on the book; ***b*** when a motor car pulls a trailer the pull of the trailer on the car is equal and opposite to the pull of the car on the trailer. ↑ REST[2]

EB015 mechanics (*n.*) The study of the effects of forces on bodies; it can be divided into two parts: **statics**, the effect of forces on bodies in equilibrium; **dynamics**, the effect of forces on bodies at rest or in motion. ↑ REST[2] → STATICS

EB016 dynamics (*n.pl.*) See MECHANICS (↑). Dynamics so described is usually called classical, or Newtonian, dynamics, to distinguish it from relativistic dynamics. Dynamics can be divided into **kinematics** and **kinetics**. ↑ REST[2] → KINEMATICS

EB017 kinetics[1] (*n.sing.*) The study of the motion in space of real bodies. Reference is made in kinetics to the cause of the motion of bodies, *i.e.* the forces acting on a body, and the mass of the body, are both considered. The dimensions of a body may or may not be considered. Kinetics is concerned with forces, energy and work, and with the relationship between these quantities. These quantities are also considered in relation to kinematics. —KINETIC (*adj.*) ↑ REST[2] → KINEMATICS (H)

EB018 Newtonian mechanics (*n.*) A system of mechanics based on Newton's laws of motion; it concerns the motion of bodies travelling at velocities normally observed in objects moving on the Earth. Also called ***classical mechanics.*** ↑ REST[2] → RELATIVISTIC MECHANICS

EB019 momentum (*n., pl.* **momenta**) A property of a body in motion; it is measured by time taken for a given force to bring the body to rest. Momentum is calculated from the product of the mass of the body and its velocity. A body of mass m travelling with a constant velocity v has a momentum mv. Momentum is a vector quantity and momenta are added by vector diagrams. For velocities approaching the velocity of light, the relativistic mass must be used in the calculation of momentum. Momentum is given the symbol p; the units are newton-seconds. ↓ CONSERVATION OF MOMENTUM · IMPULSE[2] · COLLISION · ELASTIC COLLISION · INELASTIC COLLISION · IMPACT ↑ FORCE → RELATIVISTIC MASS

EB020 conservation of momentum (*n.*) The principle that in any collision between two bodies, the total momentum in any direction is unchanged, providing no external force acts in that direction. For example, if two bodies, A and B collide, each exerts an impulse on the other; by Newton's third law, these impulses are equal. Since impulse is equal to the rate of change of momentum, the changes in momentum are equal, but opposite in direction. One body gains momentum and the other loses an equal amount of momentum, so momentum is neither lost nor gained, *i.e.* momentum is conserved. ↑ MOMENTUM

EB021 impulse[2] (*n.*) The impulse of a force is equal to the change of momentum it produces; it is calculated from the product of the force and the time the force acts, assuming a constant force:

impulse = force × time = Ft = change of momentum

—***impulsive*** (*adj.*) ↑ MOMENTUM

EB022 collision (*n.*) When two bodies in motion are not acted upon by any other force, and meet so as to modify each other's motion, the two bodies are in collision, *e.g.* ***a*** two balls moving on a flat surface roll towards each other and meet in collision; their motion is modified; ***b*** two motor cars travelling along a road meet in collision, and their speeds, or velocities, are changed. In collisions, two principles are observed, ***a*** momentum is conserved; ***b*** the modification of the velocities depends on the elasticity of the material of the colliding bodies □ *two bodies meet in collision with each other; a collision between two motor cars*

—***colliding*** (*adj.*) COLLIDE (*v.*) ↑ MOMENTUM

EB023 elastic collision (*n.*) In an elastic collision, the total momentum of the bodies is conserved. If they are perfectly elastic, the coefficient of restitution is equal to unity, so the velocity of separation is equal to the velocity of approach, and no mechanical energy is lost in the collision. In practice the coefficient of restitution for any material is less than unity, so elastic collisions do not occur between objects made of actual materials; they are assumed to occur between molecules of a gas. ↑ MOMENTUM

EB024 inelastic collision (*n.*) In an inelastic collision, part of the energy of the colliding bodies is dissipated in sound, heat and deformation of the bodies. The momentum of the bodies is conserved, *i.e.* the total momentum of the bodies before and after collision is the same. The relative velocities are altered according to the coefficient of restitution of the materials of the two bodies. For example, two motor cars, A and B, meet in a head-on collision; the data for the collision are:

Motor car	*A*	*B*
Mass	800 kg	500 kg
Initial speed	$+20$ km h^{-1}	-34 km h^{-1}
Final speed	-15 km h^{-1}	$+22$ km h^{-1}
Coefficient of restitution		0·685

Total momentum before
$= 800 \text{ kg} \times 20 \text{ km h}^{-1} - 500 \text{ kg} \times 34 \text{ km h}^{-}$
$= -1000 \text{ kN h}^{-1}$

Total momentum after
$= .-800 \text{ kg} \times 15 \text{ km h}^{-1} + 500 \text{ kg} \times 22 \text{ km h}^{-1}$
$= -1000 \text{ kN h}^{-1}$

$$\frac{\text{speed of separation}}{\text{speed of approach}} = \frac{22-(-15)}{20-(-34)} = \frac{37}{54} = 0{\cdot}685$$

In the collision, the momentum before is equal to the momentum after; the speed of separation depends on the coefficient of restitution and the speed of approach. Both motor cars are halted by the collision and reversed in direction after the collision (shown by the change in sign of the speed).

EB025 impact (*n.*) The occurrence connected with an impulse. When two bodies collide, there is an impact of one body on the other; the impact gives rise to an impulse, *e.g.* the moment of impact is the point in time when a body in motion gives an impulse to an object. To contrast **impact** and **collision**: two motor cars are in collision, *i.e* they both collide with no further description of the event; the impact of one car caused damage to the other car (an occurrence of an impulse, with impact referring to one car only). —***impact*** (*v.*) ***impacted*** (*adj.*) ↑ MOMENTUM

EB026 inertia (*n.*) That property of matter which causes a body (a piece of matter) to remain at rest or, if moving, to continue its motion in a straight line unless acted upon by an outside force. It is also a quantity, *i.e.* a measure of the property. The quantity is measured by the force which overcomes the inertia to produce a change in motion, *e.g.* a driver puts his car out of gear and switches off the engine; the car continues in motion unless a force (the brakes, or the friction of the road surface, or an uphill slope) stops the car. —***inertial*** (*adj.*) ↓ INERTIAL MASS · MOMENT OF INERTIA[1]

EB027 inertial mass (*n.*) The mass of a body defined from its property of inertia. A force is required to overcome inertia and to accelerate the body. The inertial mass is measured from the force and the acceleration produced, *e g.* a force of 1600 N acting on a motor car accelerates the car at 2 m s^{-2}, the

inertial mass of the car is:

$$1600 \text{ N} \div 2 \text{ m s}^{-2} = 800 \text{ kg}$$

In Newtonian mechanics it appears incidental that inertial mass should be the same as gravitational mass; in relativity mechanics the fact they are equal is essential to the theory of relativity. ↑ INERTIA → GRAVITATIONAL MASS

EB028 moment of inertia[1] (*n.*) The measure of a body's resistance to a change in its angular velocity; it is measured with respect to an axis of the body. If the body consists of masses m_1, m_2, m_3 . . . . respectively at distances r_1, r_2, r_3 . . . . from the axis, then:

$$I = m_1r_1^2 + m_2r_2^2 + m_3r_3^2 + \ldots . = \Sigma\, mr^2$$

where I is the symbol for the moment of inertia; the units of measurement are kg m^2. ↑ INERTIA

EB029 vehicle (*n.*) **1** A general term to describe any form of land or air transport, *e.g.* a cart, a motor car, an aeroplane. **2** A substance in which solid substances are suspended, *e.g.* pigments are suspended in oil to form paint; oil is the vehicle for the pigments. ↓ MODULE · TROLLEY · MOTOR[3] ↑ FORCE → PIGMENT

EB030 module (*n.*) A detachable section of a vehicle, machine, or device; usually the module has a function which is self-contained and takes part in the function of the whole, *e.g.* ***a*** module of a spacecraft (function of transporting astronauts); ***b*** a module of a computer. ↑ VEHICLE

EB031 trolley (*n.*) A small, low box on wheels, used in experiments on forces and accelerations. ↑ VEHICLE

EB032 motor[3] (*n.*) A device for transforming one form of energy into the kinetic energy of motion, *e.g.* an electric motor transforms electrical energy into kinetic energy. ↑ VEHICLE

EB033 constrain (*v.t.*) To make a body stay in a particular position or in a particular state of motion. To contrast **constrain** and **restrain**: in restrain, the agent prevents a particular action; in constrain, the agent prevents any course of action other than the one which is the subject of the constraint, *e.g.* the rails constrain a train to travel along a fixed path; the driver restrains the train from travelling too fast down a hill by applying the brakes. —***constraint*** (*n.*) ***constraining*** (*adj.*) ↓ RESTRAIN · COLLIDE[2] · RESIST · WITHSTAND[2] ↑ FORCE

EB034 restrain (*v.t.*) To prevent an action taking place; the agent of restraint is usually a force, *e.g.* ***a*** gravity tends to cause a body to slide down a sloping surface, friction prevents this action and restrains the body; ***b*** a piece of metal tends to fall under gravity; a rope tied to the piece of metal restrains it from falling (tension in the rope is the restraining force). —***restraint*** (*n.*) ***restraining*** (*adj.*) ↑ CONSTRAIN

EB035 collide[2] (*v.i.*) To meet in collision. If two bodies, *e.g.* two motor cars, two molecules, two balls, are travelling in exactly opposite directions, they collide **head-on** □ *the bicycle collided with the car* ↑ CONSTRAIN

EB036 resist (*v.t.*) To oppose a force or to prevent an attack by an agent having an effect; the term implies an active opposition, either the reaction of a force or a reaction by an agent, *e.g.* ***a*** frictional forces between rough surfaces resist a force trying to move a body; ***b*** a person resists disease through the reaction of antibodies to pathogens; ***c*** water resists the motion of a ship (viscid forces prevent the motion). —RESISTANCE (*n.*) ***resistant*** (*adj.*) ↓ WITHSTAND[2] (Sn) ↑ CONSTRAIN

EB037 withstand[2] (*v.t.*) To oppose an attack by an agent, or by conditions; the term implies a passive opposition, as a result of the structure or the properties of the object, *e.g.* ***a*** hard glass is a material able to withstand high temperatures; ***b*** gold withstands the attack of concentrated hydrochloric acid. ↑ CONSTRAIN

EB038 mobile[1] (*adj.*) Describes an object that is easily moved. An inanimate object is mobile; it needs an agent, such as a motor or a man to move it. The term is also used to describe liquids that flow readily, *e.g.* alcohol and petrol are mobile liquids □ *highly mobile* —MOBILITY (*n.*) ↓ DYNAMIC · STATIC[1] · TENSE ↑ FORCE → MOTILE · VISCOUS[2] (Ag) · IMMOBILE (An)

EB039 dynamic (*adj.*) Of or to do with motion or force. ↓ STATIC[1] (An) ↑ MOBILE[1]

EB040 static[1] (*adj.*) (Of material bodies) at rest; in equilibrium; in unchanging conditions. ↑ MOBILE[1] · DYNAMIC (An)

EB041 tense (*adj.*) Describes a body, string, bar, etc., that is under tension. ↑ MOBILE[1]

EB042 gravitation (*n.*) The attractive force between any two pieces of matter, *i.e.* material bodies; the magnitude of the force depends on the mass of the bodies and the distance between them. —GRAVITATIONAL (*adj.*) ↓ NEWTON'S LAW OF UNIVERSAL GRAVITATION · UNIVERSAL GRAVITATION · GRAVITATIONAL MASS · CENTRE OF MASS · BALANCE[1] · GRAVITATE · GRAVITATIONAL (Sn) ↑ FORCE

EB043 Newton's law of universal gravitation (*n.*) Any two pieces of matter attract one another with a force which is proportional to the product of their masses and inversely proportional to the square of their distance apart. The force of attraction, F, between two masses, m_1 and m_2, respectively, when placed at a distance apart, d, is:

$$F = \frac{G\, m_1 m_2}{d^2}$$

where G is the gravitational constant. ↓ GRAVITATIONAL CONSTANT · GRAVITATIONAL FIELD · GRAVITY · UNIVERSAL GRAVITATION · ACCELERATION DUE TO GRAVITY · ACCELERATION OF FREE FALL ↑ GRAVITATION

EB044 gravitational constant (*n.*) The constant of proportionality, G, in Newton's Law of universal gravitation. If two equal

masses of 1 kg are placed 1 m apart, the force between them is $6{\cdot}670 \times 10^{-11}$ newtons. The value of the gravitational constant is $6{\cdot}670 \times 10^{-11}\,N\,m^2\,kg^{-2}$. ↑ NEWTON'S LAW OF UNIVERSAL GRAVITATION

EB045 gravitational field (*n.*) The region around an object in which another object experiences a gravitational force of attraction. It is a vector field and can be represented by lines of gravitational force which indicate the direction of the vector at any point. The density of the field (number of lines per unit area) is proportional to the magnitude of the field. The gravitational field of a planet is the region under its influence. The gravitational fields of all the planets meet in space at points where the gravitational forces from any two planets are exactly equal. This defines the limit of the gravitational field of any one planet; the limits change because the planets move relative to one another. ↑ NEWTON'S LAW OF UNIVERSAL GRAVITATION

EB046 gravity (*n.*) The gravitational force between the Earth and a body either on the Earth's surface or in the Earth's gravitational field. The force decreases as the distance from the Earth increases; the force of gravity is inversely proportional to the square of the distance. ↑ NEWTON'S LAW OF UNIVERSAL GRAVITATION

EB047 universal gravitation (*n.*) A more complete description of gravitation indicating that the force of gravity exists throughout the universe. ↑ NEWTON'S LAW OF UNIVERSAL GRAVITATION

EB048 acceleration due to gravity (*n.*) The acceleration caused by the force of gravity acting on a body falling freely in a vacuum; it varies (by about ± 0·3 per cent from a mean value) in different localities on the Earth. The mean accepted value is 9·8065 $m\,s^{-2}$; the acceleration being least at the Equator and greatest at the Poles. The variation in value arises from the variation of the distance of the Earth's surface from its centre of mass. The symbol for the acceleration due to gravity is *g*. ↑ NEWTON'S LAW OF UNIVERSAL GRAVITATION

EB049 acceleration of free fall (*n.*) Alternative term for ACCELERATION DUE TO GRAVITY. ↑ NEWTON'S LAW OF UNIVERSAL GRAVITATION

EB050 gravitational mass (*n.*) The mass of a body can be defined from the gravitational attraction it has for other bodies; it is calculated from the equation for universal gravitation. ↓ WEIGHT · STANDARD MASS · WEIGHTLESSNESS · G ↑ GRAVITATION

EB051 weight (*n.*) The force with which the Earth attracts a body is the weight of that body; weight is measured in newtons. At any one point on the Earth, weight is proportional to mass as the force of gravity produces a constant acceleration at that point. The mass of a body is constant (by Newton's principles), but its weight varies depending upon its position on the Earth's surface (the weight is least at the Equator and greatest at the Poles), and upon its height above the Earth's surface (the greater the height, the less the weight). A body of mass *m* has a weight *mg*, where *g* is the acceleration due to gravity. —***weightless*** (*adj.*) ↑ GRAVITATIONAL MASS → WEIGH · MASS

EB052 standard mass (*n.*) A piece of metal whose mass is known accurately. A standard kilogramme is kept as an official measure of mass, and all other standard masses are measured ultimately by comparison with this standard kilogramme. ↑ GRAVITATIONAL MASS

EB053 weightlessness (*n.*) A person in a freely falling box would be accelerated by the Earth's gravitational attraction at the same rate as the box, so no force would be needed to keep him in his position relative to the box. He would have no sensation of weight and would experience weightlessness. An astronaut in a spacecraft circling the Earth would experience weightlessness, as the Earth's gravitational attraction is exactly equal to the centripetal force needed to keep the spacecraft in orbit. There is no net force acting, so the astronaut experiences no acceleration, and thus has no sensation of weight. ↑ GRAVITATIONAL MASS

EB054 G A measure of the force acting on a person in an aircraft or spacecraft when it turns sharply or rises up rapidly. One G is equal to the normal force of gravity. An airman at rest, of weight 750 newtons, when experiencing a force of 3 G has a weight of $3 \times 750 = 2250$ newtons ↑ GRAVITATIONAL MASS

EB055 centre of mass (*n.*) The point in a body, or a system of bodies, at which its entire mass may be assumed to act for the purpose of calculation of gravitational forces, *e.g.* the centre of mass of the Earth is used for calculating the Earth's gravitational attraction for the moon; the centre of mass is at the geometric centre of the Earth. For bodies under the influence of gravity, the centre of mass is identical with the centre of gravity. ↓ CENTRE OF GRAVITY · CENTRE OF INERTIA · PLUMBLINE · PLUMBRULE ↑ GRAVITATION

EB056 centre of gravity (*n.*) The point in a body at which the weight of the body appears to act. It is defined as the point of application of the resultant force due to the Earth's attraction on the body. When a body is supported at its centre of gravity, it is balanced. ↑ CENTRE OF MASS

EB057 centre of inertia (*n.*) Alternative term for the CENTRE OF GRAVITY.

EB058 plumbline (*n.*) A heavy bob suspended by a string, used to obtain or check vertical lines. At rest, the plumbline sets in a vertical direction (towards the centre of mass of the Earth). ↑ CENTRE OF MASS

EB059 plumbrule (*n.*) An instrument consisting of a plumbline mounted in a wooden frame; it is used to test whether a building or a wall is perpendicular to the horizontal, *i.e.* exactly vertical. ↑ CENTRE OF MASS

EB060 balance[1] (*n.*) An instrument for measuring mass or weight. Mass is measured by a beam balance, a lever balance, or a steelyard; weight is measured directly by a spring balance. —BALANCE (*v.*) ↓ BEAM BALANCE · LEVER BALANCE · STEELYARD · MICROBALANCE · SPRING BALANCE · PAN · SENSITIVITY[2] ↑ GRAVITATION

EB061 beam balance (*n.*) An instrument consisting of a lever with two equal arms, from the ends of which pans are suspended. The beam is mounted on a knife edge (agate edges are used in a sensitive balance), with its centre of gravity above the knife edge, and the two arms on either side of the mounting. Equal masses placed on the two pans have equal weights, and these equal forces balance the beam in a horizontal position. An unknown mass can be measured by balancing it against standard masses. ↑ BALANCE[1]

EB062 lever balance (*n.*) A type of balance that has a single pan. When an unknown mass is placed in the pan, the pan sinks, raising a metal block as it does so. The mass in the pan is balanced by the metal block through a system of levers. A graduated scale indicates the mass of the object. ↑ BALANCE[1]

EB063 steelyard (*n.*) A type of balance consisting of a rigid metal bar and a lever with two unequal arms on either side of its centre of gravity; a pan on a hook is suspended from the shorter arm. The steelyard is pivoted at its centre of gravity. A movable mass slides along the longer arm, which is graduated to read mass in grammes or kilogrammes. An unknown mass in the pan is balanced by sliding the movable mass along the arm until the steelyard is balanced. Equal moments of the two weights balance the beam and the mass is read off the graduated scale of mass. ↑ BALANCE[1]

EB064 microbalance (*n.*) A very sensitive balance capable of weighing a mass to the nearest 10^{-6} mg; the load in such a balance is limited to a maximum of 250 mg. ↑ BALANCE[1]

EB065 spring balance (*n.*) An instrument in which an unknown mass is suspended by a hook or placed in a pan, which extends a vertical spring. The extension of the spring is proportional to the weight of the unknown mass, and a calibrated scale indicates the weight. The same object weighed by a spring balance in different localities of the Earth can give different readings (the maximum difference will be small, for example ±0·3 kg in 100 kg). ↑ BALANCE[1]

EB066 pan (*n.*) A flat object, usually circular, in which masses to be weighed are placed on a balance. ↑ BALANCE[1]

EB067 sensitivity[2] (*n.*) The degree of accuracy to which a balance will weigh a mass; a sensitive balance will weigh a mass to the nearest 0·1 mg. In general, the degree of accuracy to which any instrument will measure a quantity, *e.g.* the sensitivity of an ammeter describes the smallest difference in electric current the instrument will detect. ↑ BALANCE[1]

EB068 gravitate (*v.i.*) To move under the force of gravity, *i.e.* downwards towards the Earth. ↓ BALANCE[2] · WEIGH · TILT ↑ GRAVITATION

EB069 balance[2] (*v.t.,i.*) **1** (*v.i.*) (Of a rigid body) to be in a state of rest under opposing forces, usually in a horizontal or vertical position, with the body resting on a support. A small force displaces the body but, if the body is balanced, it returns to its position of rest. **2** (*v.t.*) To hold under equal and opposing forces, *e.g.* ***a*** a chemical equation is balanced when the number of atoms on each side of the equation is equal for all the elements concerned; ***b*** a metre bridge is balanced when the opposing e.m.f.'s are equal □ *a rod is balanced about its support* —BALANCE (*n.*) ***unbalance*** (*v.*) ***balanced*** (*adj.*) ↑ GRAVITATE

EB070 weigh (*v.t.,i.*) **1** (*v.t.*) To use a balance to determine either the mass or the weight of an object. The mass of an object is determined by weighing on a beam balance. The weight of an object is determined by weighing on a spring balance. **2** (*v.i.*) To be attracted to the Earth by a force, *e.g.* an object of mass 1 kg is attracted to the Earth by a force of 10 N, *i.e.* it weighs 10 N. —WEIGHT (*n.*) ↑ GRAVITATE

EB071 tilt (*v.t.,i.*) To put at or to come into a sloping position. ↑ GRAVITATE

EB072 gravitational (*adj.*) Of or to do with gravitation or gravity. ↓ TERRESTRIAL[1] ↑ GRAVITATION

EB073 terrestrial[1] (*adj.*) Of or to do with the Earth, *e.g.* ***a*** a terrestrial telescope is one for use on the Earth; ***b*** a terrestrial observation is one made on the Earth; the object observed can be on Earth or in space. ↑ GRAVITATIONAL

Projectiles, Friction

EC001 projectile (*n.*) Any body which is projected by an impulse, usually caused by an explosion, so that the body moves through the air, *e.g.* a bullet fired from a gun is a projectile. A projectile always remains within the Earth's gravitational field. ↓ MISSILE · CENTRIPETAL FORCE · JET ENGINE · BALLISTIC PENDULUM · SOLAR SYSTEM ·

JETTISON · CENTRIPETAL · BALLISTIC → FORCE

EC002 missile (*n.*) A projectile used for investigation or for war. Missiles are either ballistic or guided. ↓ BALLISTIC MISSILE · GUIDED MISSILE · SPACE PROBE · SPACECRAFT · SPACESHIP · SPACE CAPSULE · SATELLITE · ASTRONAUT · TRAJECTORY · ORBIT[2] ↑ PROJECTILE

EC003 ballistic missile (*n.*) A missile projected by an impulse; its path is dependent only on the initial direction, the thrust, and the force of gravity. ↑ MISSILE

EC004 guided missile (*n.*) A missile whose path is controlled by a mechanism inside it so that its path can be altered at any time to make it reach a target. ↑ MISSILE

EC005 space probe (*n.*) A missile with a rocket engine, propelled with a sufficiently great initial velocity to escape from the Earth's gravitational field. It carries instruments to make observations on the solar system which cannot be made from the Earth; the missile is unmanned and observations are transmitted to Earth by radio signals. A **moon-probe**, or **lunar probe**, is a space probe for investigating the Moon. ↑ MISSILE

EC006 spacecraft (*n.*) A vehicle equipped with a rocket engine for travelling in space and capable of carrying astronauts. ↑ MISSILE

EC007 spaceship (*n.*) An alternative term for SPACECRAFT. ↑ MISSILE

EC008 space capsule (*n.*) The part of a spacecraft containing controls and instruments for making observations; it is detachable from the spacecraft for a separate landing. ↑ MISSILE

EC009 satellite (*n.*) A smaller body travelling in an orbit round a larger body, *e.g.* ***a*** the Earth is a satellite of the Sun; ***b*** the Moon is a satellite of the Earth; ***c*** a spacecraft which travels in an orbit round the Earth is an artificial satellite. ↑ MISSILE

EC010 astronaut (*n.*) A person in a space capsule who directs the path of a space craft and takes observations in space. ↑ MISSILE

EC011 trajectory (*n.*) The path of a projectile. It has the shape of a parabola, as the initial acceleration imparted by the thrust decreases because of air resistance, and the acceleration due to gravity causes it to fall slowly back to the ground. ↑ MISSILE

EC012 orbit[2] (*n.*) The path of a body in motion round a central body exerting a centripetal force on the moving body, *e.g.* ***a*** a planet moves in its orbit round the sun; ***b*** a satellite moves in its orbit round the Earth □ *a satellite in orbit.* —ORBITAL (*adj.*) ↑ MISSILE

EC013 centripetal force (*n.*) A force which causes a body to travel in a circular path, or in any arc of a circle, *e.g.* if the tension in a string keeps a body travelling in a circle at a constant linear velocity, then the tension in the string is equal to the centripetal force. If the mass of the body is m, its constant linear velocity is v, the radius of the circular path is r, then the centripetal force is $\frac{mv^2}{r}$ and it is measured in newtons. If the angular velocity of the body is ω (the Greek letter omega), the centripetal force is $mr\omega^2$. ↓ CENTRIFUGAL FORCE · CENTRIPETAL ACCELERATION ↑ PROJECTILE

EC014 centrifugal force (*n.*) The reaction of a body travelling in a circular path. The centrifugal force is equal and opposite to the centripetal force. The effect of centrifugal force is noticed when a motor car or a train goes round a sharp curve at speed. The people feel pushed outwards by the centrifugal force. —CENTRIFUGE (*n.*) ↑ CENTRIPETAL FORCE

EC015 centripetal acceleration (*n.*) If a body is travelling at a constant linear speed, it accelerates when it moves in a curved path, as its velocity changes because of the change in direction. If the uniform linear speed of the body is v, and the radius of the circular path is r, the centripetal acceleration is $\frac{v^2}{r}$; if the uniform angular velocity of the body is ω, the centripetal acceleration is $r\omega^2$. ↑ CENTRIPETAL FORCE

EC016 jet engine (*n.*) An aircraft engine used to provide jet propulsion. Air is taken in at the front of the engine, the air is then compressed by a radial compressor and passed into a combustion chamber. Liquid fuel is burned in the combustion chamber producing a large volume of hot gas under pressure. The gases pass through a turbine and escape through a jet at the rear of the engine, with a considerable velocity. Part of the energy of the gas drives the turbine, which in turn drives the radial compressor. ↓ REACTION PROPULSION · JET PROPULSION · ROCKET ENGINE · RETRO-ROCKET · PROPELLANT · ROCKET ↑ PROJECTILE

EC017 reaction propulsion (*n.*) A method of propulsion depending upon the principle that action and reaction are equal and opposite. The action is produced by an engine in the form of a stream of hot gas issuing from the rear of the engine. The reaction propels the engine forward. If the engine requires air as an oxidant for the fuel, then it is a jet engine and jet propulsion takes place. If the engine carries a chemical oxidant and is independent of atmospheric air, it is a chemical rocket engine and reaction propulsion takes place. ↑ JET ENGINE

EC018 jet propulsion (*n.*) Propulsion of an aircraft in which a jet engine produces a high-velocity jet of gas at the rear of the engine. The momentum of the gas produces a reaction by the jet engine which, by Newton's third law, is equal and opposite to the thrust of the gas. This reaction propels the aeroplane through space. ↑ JET ENGINE → REACTION

EC019 rocket engine (*n.*) An engine that operates in a similar manner to a jet engine, but carries oxidants for fuels instead of using air; this enables a rocket engine to function outside the Earth's atmosphere. ↑ JET ENGINE → OXIDANT

EC020 retro-rocket (*n.*) A small rocket

engine supplying a thrust opposite in direction to that of a main rocket engine; its purpose is to decelerate a spacecraft, particularly to lessen the impact of landing. ↑ JET ENGINE

EC021 propellant (*n.*) Any substance producing the energy required for jet propulsion; it can be a fuel or an oxidant. ↑ JET ENGINE

EC022 rocket (*n.*) A projectile carrying its own propellants, and driven by reaction propulsion; the propellants include fuel and oxidants. Rockets used for space travel can be single stage or multi-stage; in the latter, the stages can be jettisoned when the propellants are exhausted. ↑ JET ENGINE

EC023 ballistic pendulum (*n.*) A heavy body freely suspended from a support, used to measure the velocity of a projectile. The projectile gives the body an impulse on impact and the pendulum is displaced. The velocity of the projectile can be calculated from the displacement. ↓ BALLISTICS · AERODYNAMICS · CENTRIFUGE ↑ PROJECTILE

EC024 ballistics (*n.*) The study of bodies in ballistic motion. ↑ BALLISTIC PENDULUM

EC025 aerodynamics (*n.*) See **EC081.** ↑ BALLISTIC PENDULUM

EC026 centrifuge (*n.*) A device for separating suspended particles from a liquid by the centrifugal force caused by high-speed rotation. A common type has a horizontal rotating arm with identical containers at each end. One container holds the sample; the other is used for balance. When the arm rotates the containers pivot outwards, and solid particles are carried to the bottom by centrifugal force. —CENTRIFUGE (*v.*) ↑ BALLISTIC PENDULUM

EC027 solar system (*n.*) The system of the sun and nine planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto) with their moons, and a belt of asteroids, all revolving in their orbits. The orbits of the planets are elliptical and are approximately in the same plane. Universal gravitation supplies the centripetal force keeping the planets in their orbits. ↓ METEOR · METEORITE ↑ PROJECTILE

EC028 meteor (*n.*) A small, solid body moving freely in outer space. If it enters the Earth's atmosphere, frictional forces on the meteor's surface produce heat, and it becomes incandescent. Small meteors burn completely to gases, but larger ones reach the Earth, and are known as meteorites. A large number of meteors (about a million) enter the Earth's atmosphere daily. ↑ SOLAR SYSTEM

EC029 meteorite (*n.*) A meteor which has reached the Earth. There are two main types: one type is predominantly stone, the other predominantly iron and nickel. The largest meteorites have a mass of up to 100 tonnes. ↑ SOLAR SYSTEM

EC030 jettison (*v.t.*) To throw objects off a ship to lighten it; to throw away objects which are no longer needed or no longer of use. ↑ PROJECTILE

EC031 centripetal (*adj.*) Tending to move towards a centre. ↓ CENTRIFUGAL (Cn) ↑ PROJECTILE

EC032 centrifugal (*adj.*) Tending to move away from a centre. ↑ CENTRIPETAL (Cn)

EC033 ballistic (*adj.*) Of or to do with bodies projected by an external impulsive force, *e.g.* ballistic motion is the motion of projectiles. ↓ SOLAR ↑ PROJECTILE

EC034 solar (*adj.*) Of or to do with the sun, *e.g.* solar energy is energy from the sun. ↑ BALLISTIC → TERRESTRIAL[1]

EC035 relativity (*n.*) All motion is measured by an observer, and as the observer is on Earth, he himself is moving in space, with a motion arising firstly from the rotation of the Earth, and secondly from the Earth's revolution round the Sun, etc. An observer must therefore always observe any motion relative to himself and he provides a frame of reference for speed and velocity. Different observers will have different frameworks of reference, particularly with regard to time. The theory of relativity, formulated by Einstein, deals with the interrelation of space, time and energy, and restates the laws of mechanics so that they do not depend upon any particular observer's framework of reference. —***relativistic*** (*adj.*) ↓ SPECIAL THEORY OF RELATIVITY · GENERAL THEORY OF RELATIVITY · RESTRICTED THEORY OF RELATIVITY · RELATIVISTIC MECHANICS · SPACE-TIME · REST MASS ↑ FORCE

EC036 special theory of relativity (*n.*) This is the first part of the theory of relativity, in which all observers are assumed to be in uniform motion in a straight line at a constant velocity relative to each other. It is deduced from two axioms, ***a*** the velocity of light is the same for all observers, irrespective of their own velocity, and it is the maximum velocity attainable in the universe: ***b*** the laws governing natural phenomena are the same for all observers. Some of the important results of this theory are, ***a*** Newton's assumption that mass was constant under all conditions is not valid, and the mass of a body depends upon its velocity (see **relativistic mass**); ***b*** mass and energy are equivalent and interchangeable (see **mass-energy equation**); ***c*** the impossibility of measuring absolute motion; ***d*** the concept of a space-time continuum with four dimensions. ↓ RESTRICTED THEORY OF RELATIVITY (Sn) ↑ RELATIVITY

EC037 general theory of relativity (*n.*) This is the second theory of relativity and is an expansion of the first theory; it formulates new laws to account for gravitational phenomena. The theory is applicable to observers not in uniform motion relative to each other. It states that gravitation is a property of space itself and that light is deflected in a gravitational field. ↑ RELATIVITY

EC038 restricted theory of relativity (*n.*) Alternative term for the SPECIAL THEORY OF RELATIVITY (↑)

EC039 relativistic mechanics (*n.*) A system

of mechanics based on Einstein's Theory of Relativity; it concerns the motion of bodies travelling at very high velocities, *i.e.* those approaching the speed of light (3×10^8 m s^{-1}), in addition to the velocities normally observed in objects moving on the Earth. ↓ PRINCIPLE OF EQUIVALENCE · CONTINUUM ↑ RELATIVITY

EC040 principle of equivalence (*n.*) Suppose an observer is standing in a closed box, and the box is in space away from the Earth or other planetary bodies, so that no gravitational forces act. The box is assumed to be moving with a constant velocity. The observer has no sensation of weight, and a small force would project him to the top of the box, where he would remain; all objects in the box float freely, *i.e.* remain wherever they are placed. If the observer throws an object, it will travel in a *straight line.* This state of no gravitation is **straight line space.** Now suppose the sensation of weight returns to the observer, and all objects fall to the bottom of the box. The observer could say either, *a* a gravitational force was acting, or *b* the box was accelerating in the direction of the top of the box; either alternative would produce the same effect on the observer. An object thrown parallel to the bottom of the box would travel in a curved path towards the bottom of the box. This state of gravitation is **curved space.** The principle of equivalence states that there is no difference between the effects of gravitation and those of acceleration of the surroundings (*i.e.* the box discussed above), and the two effects are indistinguishable to an observer. To an observer, matter in space causes space to curve and set up a gravitational field. In Newtonian mechanics, gravitation is a force attracting bodies together; in relativistic mechanics, gravitation is a characteristic of curved space. ↑ RELATIVISTIC MECHANICS

EC041 continuum (*n.*) A medium exhibiting continuity throughout its infinite extent, being continuous in space, time, or property; if able to undergo change, to a limited extent, the change is gradual, so that the properties remain continuous. ↑ RELATIVISTIC MECHANICS

EC042 space-time (*n.*) The theory of relativity has shown there is no distinction between three-dimensional space and an independent linear time. Time and space must be considered together to form a four-dimensional continuum. ↓ MASS-ENERGY EQUATION ↑ RELATIVITY

EC043 mass-energy equation (*n.*) According to the special theory of relativity, mass and energy are equivalent. Einstein's equation is:

$$E = mc^2$$

where E is energy, m is mass, and c is the speed of light in space (3×10^8 m s^{-1}). One gramme of matter is equivalent to

$$0{\cdot}001 \times (3 \times 10^8)^2 = 9 \times 10^{13} \text{ J.}$$

Conversions of mass to energy take place in atomic fission and fusion. ↑ SPACE TIME

EC044 rest mass (*n.*) The assumed mass of a particle, or a body, if it were motionless, or at rest, relative to an observer. ↓ RELATIVISTIC MASS · RELATIVISTIC PARTICLE · RELATIVISTIC VELOCITY ↑ RELATIVITY → GRAVITATIONAL MASS · INERTIAL MASS

EC045 relativistic mass (*n.*) The mass of a body increases with its velocity. For all ordinary velocities, the increase is insignificant. The relativistic mass is the mass of a body when it is travelling at a velocity comparable to that of light in a vacuum. If the body has a rest mass m_0, travels at a velocity v, then its relativistic mass, m, is given by:

$$m = \frac{m_0}{\left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}}}$$

where c is the velocity of light.

As the velocity of the body approaches the velocity of light, its mass tends to be infinitely great. ↑ REST MASS

EC046 relativistic particle (*n.*) A particle with a relativistic mass appreciably different from its rest mass, *i.e.* one with a relativistic velocity. Many cosmic ray particles entering the Earth's atmosphere from space are relativistic particles; a beta particle in radioactive radiation also approaches this condition. ↑ REST MASS

EC047 relativistic velocity (*n.*) A velocity, sufficiently close to the velocity of light, at which the theory of relativity produces significant differences from calculations made on the principles of Newtonian mechanics. ↑ REST MASS

EC048 friction (*n.*) The phenomenon of forces offering resistance to the relative motion of two solid surfaces in contact, *e.g.* when a wooden case is dragged across a stone floor, there is resistance against the motion of the case, *i.e.* there is friction between the case and the floor; the resistance is a frictional force □ *there is friction between the two surfaces* —FRICTIONAL (*adj.*) ↓ STATIC FRICTION · TRIBOLOGY · BRAKE[1] · DRAG[2] · FRICTIONAL ↑ FORCE

EC049 static friction (*n.*) This is the friction between two surfaces not in motion, but brought into being by an attempt to move the surfaces relative to each other. Static friction has to be overcome in order that one surface moves over the other, *e.g.* a wooden case on an inclined plank does not move; static friction opposes the gravitational force, so that it remains stationary and does not slide down the plank. ↓ LIMITING FRICTION · KINETIC FRICTION · SLIDING FRICTION · DYNAMIC FRICTION ↑ FRICTION

EC050 limiting friction (*n.*) The maximum force exerted by static friction; when limiting friction is just overcome, a body starts to move over a rough surface. ↑ STATIC FRICTION

EC051 kinetic friction (*n.*) The friction between two surfaces in motion relative to each other, *e.g.* when an axle rotates in a bearing, there is kinetic friction between the two, resulting in a loss of power. Friction

between moving parts produces heat. Kinetic friction is less than static friction. ↑ STATIC FRICTION

EC052 sliding friction (*n.*) Alternative term for KINETIC FRICTION.

EC053 dynamic friction (*n.*) Alternative term for KINETIC FRICTION.

EC054 tribology (*n.*) The study of frictional forces and the effect of lubrication. ↓ LAWS OF FRICTION · COEFFICIENT OF FRICTION · COEFFICIENT OF KINETIC FRICTION · COEFFICIENT OF STATIC FRICTION · ANGLE OF FRICTION ↑ FRICTION

EC055 laws of friction (*n.*) Three laws governing the relative motion of surfaces in contact. **1** Frictional force always opposes attempted relative motion. **2** The limiting frictional force between any two given surfaces is independent of the area of contact, providing the force pressing the surfaces together is the same. **3** The limiting frictional force is proportional to the normal (at right angles) reaction resulting from the force pressing the two surfaces together. ↑ TRIBOLOGY

EC056 coefficient of friction (*n.*) A measure of the friction between surfaces. The symbol for the coefficient of friction is μ (the Greek letter mu). If F is the maximum frictional force and R is the normal (at right angles) reaction, then:

$$\mu = \frac{F}{R}$$

μ is approximately constant for any two given surfaces in contact. The value is approximate as the surfaces may vary in roughness; it is independent of the mass of the body, and it is a pure number with no units. ↑ TRIBOLOGY

EC057 coefficient of kinetic friction (*n.*)

$$\mu_k = \frac{\text{Friction when slip occurs at constant speed}}{\text{Normal reaction between surfaces}}$$

The coefficient of kinetic friction is usually less than the coefficient of static friction. ↑ TRIBOLOGY

EC058 coefficient of static friction (*n.*)

$$\mu_S = \frac{\text{Limiting friction}}{\text{Normal reaction between surfaces}}$$

Note that the coefficient is independent of the area of the surfaces; it depends on the nature of the two surfaces in contact.

EC059 angle of friction (*n.*) If a body is placed on a rough surface, and the surface is inclined at an angle to the horizontal, the body remains stationary until the inclination reaches the angle of friction; the body then starts to slide down the surface. The angle of friction is determined by the coefficient of static friction; if the angle of friction is θ. $\tan\theta = \mu_s$ (coefficient of static friction). ↑ TRIBOLOGY

EC060 brake[1] (*n.*) A device used on vehicles, engines, and machines, which slows down or stops a rotating wheel by frictional forces; two rough surfaces are generally brought into contact, under considerable pressure, to increase the frictional force □ *brakes are applied to stop a moving vehicle* —BRAKE (*v.*) ***braked*** (*adj.*) ↓ TRIBOMETER · HOVERCRAFT ↑ FRICTION

EC061 tribometer (*n.*) An instrument for measuring frictional forces. ↑ BRAKE[1]

EC062 hovercraft (*n.*) A vehicle which moves over land or water supported on a pad of air, so that friction is minimal. Hovercrafts are driven forwards by a propeller. ↑ BRAKE[1]

EC063 drag[2] (*v.t.*) To pull a heavy body over a rough surface; the frictional force causes an effort to be required and makes pulling more difficult the greater the friction □ *the man dragged the heavy beam along the path* —DRAG (*n.*) ↓ LUBRICATE[1] · BRAKE[2] ↑ FRICTION

EC064 lubricate[1] (*v.t.*) To use a fluid to lessen frictional forces between two surfaces in relative motion; hydrocarbon oils are generally used for this purpose in machines and engines. —***lubrication*** (*n.*) ***lubricated*** (*adj.*) ↑ DRAG[2]

EC065 brake[2] (*v.t.*) To apply brakes to decrease the speed of, or to stop, a vehicle, engine or machine. ↑ DRAG[2]

EC066 frictional (*adj.*) Of or to do with friction, *e.g.* ***a*** frictional forces are produced between surfaces; ***b*** frictional electricity is electric charge produced by friction. ↓ LUBRICATING ↑ FRICTION

EC067 lubricating (*adj.*) Describes a substance used for lubrication, *e.g.* a lubricating oil. ↑ FRICTIONAL

EC068 viscosity[1] (*n.*) The resistance to motion offered by a fluid; either the motion of a fluid when flowing, or the motion of a solid body through the fluid. Viscosity arises from the friction between one layer of a fluid being in motion relative to another layer of the fluid, and is caused by the cohesive forces between molecules □ *the viscosity of engine oil is high, but the viscosity of water is low* —VISCOUS (*adj.*) ↓ CURRENT · COEFFICIENT OF VISCOSITY · DRAG[1] · STREAMLINE · VISCOUS[2] → FORCE

EC069 current (*n.*) The motion of a body of fluid in a definite direction, *e.g.* ***a*** a current in an ocean; ***b*** a current of air caused by convection; ***c*** the current in a river. ↓ STREAMLINE FLOW · TURBULENCE · EDDY · LAMINAR FLOW ↑ VISCOSITY[1]

EC070 streamline flow (*n.*) A manner of flow in a fluid in which parallel layers of fluid slide over each other. In streamline flow there is no mixing of fluid in a direction at right angles to the direction of flow. —STREAMLINED (*adj.*) ↓ TURBULENCE (An) ↑ CURRENT

EC071 turbulence (*n*) Motion of a fluid in which the flow is not in parallel layers, but eddies, and mixing occurs. —TURBULENT (*adj.*) ↑ CURRENT · STREAMLINE FLOW (An)

EC072 eddy (*n.*) A current in a fluid which flows round and round in a circle, and not in a straight line in the direction of the current. —***eddy*** (*v*) ↑ CURRENT

EC073 laminar flow (*n.*) The flow of a fluid when it follows closely the streamlined surface of a solid object in the fluid without turbulence. ↑ CURRENT

EC074 coefficient of viscosity (*n.*) The viscous forces in a liquid depend on the velocity gradient perpendicular to the line of flow, the cross-sectional area of flow, and a constant, the coefficient of viscosity, which depends on the nature and temperature of the liquid. The coefficient is only measurable for streamline flow. The symbol for the coefficient of viscosity (also called the ***viscosity***) is η (the Greek letter eta); the coefficient is measured in newton seconds per metre squared ($N\ s\ m^{-2}$). ↓ REYNOLD'S NUMBER · STOKE'S LAW · TERMINAL VELOCITY ↑ VISCOSITY[1]

EC075 Reynold's number (*n.*) If a fluid of density ρ (the Greek letter rho) is flowing through a tube of radius a, with a velocity v, and the coefficient of viscosity is η, then the Reynold's number, R, is given by:

$$R = \frac{va\rho}{\eta}$$

When R has a value in the region of 1000, the flow is in a condition of instability, and liable to change from streamlined to turbulent flow. ↑ COEFFICIENT OF VISCOSITY

EC076 Stoke's law (*n.*) The resistance to the motion of a solid body through a viscous liquid is stated in Stoke's law. If a sphere of radius a, falls with a velocity v, through a liquid of viscosity η, the resistance, F, experienced by the sphere is given by:

$$F = 6\pi\eta av$$

where F is a force measured in newtons. ↑ COEFFICIENT OF VISCOSITY

EC077 terminal velocity (*n.*) If a body falls freely under the force of gravity in a viscous fluid, the body accelerates from rest until the resistance to the body's motion is equal to the force of gravity; the body has then reached the terminal velocity, and cannot fall at a faster rate. A body falling through air reaches a terminal velocity, air resistance arising from viscous forces. ↑ COEFFICIENT OF VISCOSITY

EC078 drag[1] (*n.*) A resistant force opposing motion; such a force is caused by friction or by viscosity. ↓ THIXOTROPY · DILATANCY ↑ VISCOSITY[1]

EC079 thixotropy (*n.*) The property of a liquid by which it has a lower viscosity at a higher rate of flow, *e.g.* some types of paint exhibit thixotropy. Normal liquids have a viscosity independent of the rate of flow. —***thixotropic*** (*adj.*) ↓ DILATANCY (An) ↑ DRAG[1]

EC080 dilatancy (*n.*) The property of a liquid by which it has a higher viscosity at a higher rate of flow. —***dilatant*** (*adj.*) ↑ DRAG[1] · THIXOTROPY (An)

EC081 aerodynamics (*n.*) **1** The study of the effect of the shape of solid bodies on the flow of air or other gases, and of the control of the flight of bodies in air as a consequence of their shape. **2** The study of gases in motion. —***aerodynamic*** (*adj.*) ↓ BERNOUILLI'S PRINCIPLE · VENTURI TUBE · VENTURI THROAT · VENTURI METER · AEROFOIL · WING[2] · PITOT TUBE · BERNOUILLI'S THEOREM ↑ VISCOSITY[1]

EC082 Bernouilli's principle (*n.*) The principle that at any point in a fluid, under conditions of steady flow, the amount of energy per unit mass is constant. The amount of energy is the sum of the pressure energy, the kinetic energy and the potential energy of elevation. The energy in a given amount of gas is the product of its pressure and its velocity. If the sum of the energies is to remain constant, then an increase in velocity will be accompanied by a decrease in pressure. ↑ AERODYNAMICS

EC083 Venturi tube (*n.*) A device which demonstrates Bernouilli's principle. Two pipes of equal wide bore are connected by a short pipe of narrow bore. Mercury manometers are connected to all three pipes to record the pressure in the pipes. The pressure in the narrow bore pipe is lower than the pressure in the wide bore pipes, as liquid flows faster through the narrow bore pipe. ↑ AERODYNAMICS

EC084 Venturi throat (*n.*) The short pipe of narrow bore in a Venturi tube. ↑ AERODYNAMICS

EC085 Venturi meter (*n.*) An instrument using a Venturi tube to determine the rate of flow of a fluid by measuring the decreased pressure in the Venturi throat. ↑ AERODYNAMICS

EC086 aerofoil[1] (*n.*) A surface designed to aid or control the flight of an aeroplane, missile or spacecraft. ↑ AERODYNAMICS

EC087 wing[2] (*n.*) An aerofoil that provides an upward force to maintain an aeroplane in flight. The wing has a flat undersurface and a curved top surface. Air travels a greater distance over the top of the wing than under the wing, but both lots of air arrive at the rear edge at the same time. The speed of the air over the wing is greater than the speed under the wing. Hence, by Bernouilli's principle, the pressure under the wing is greater than the pressure on top of the wing, and thus a net upward force is experienced by the wing. ↑ AERODYNAMICS

EC088 Pitot tube (*n.*) A short tube, bent into a right angle, with its open end facing a current of air; the other end of the tube leads into a compartment with a diaphragm at one side. The current of air creates a pressure which distorts the diaphragm, and from the pressure thus detected the speed of the air current is determined. ↑ AERODYNAMICS

EC089 Bernouilli's theorem (*n.*) Alternative term for BERNOUILLI'S PRINCIPLE

EC090 streamline (*v.t.*) To shape a body so that a fluid flows round it in streamline flow. This minimizes the viscous forces of resistance, as turbulence would cause a backward drag on the body —STREAMLINED (*adj.*) ↑ VISCOSITY[1]

EC091 viscous[2] (*adj.*) (Of liquids) having a

high degree of viscosity, *e.g.* lubricating oil, treacle, condensed milk, are all viscous, as their viscosity is high. ↓ VISCID · TURBULENT ↑ VISCOSITY[1] → MOBILE (An)

EC092 viscid (*adj.*) (Of liquids) an alternative term for VISCOUS, but it implies in addition that the liquid is sticky, as are many viscous liquids. The focus is on the stickiness of the liquid. A viscid liquid is also described as being thick; a liquid with a low viscosity is correspondingly described as being thin; the scientific description of thin is **mobile**. ↑ VISCOUS[2] → MOBILE (An)

EC093 turbulent (*adj.*) Describes a current with turbulence in the flow. ↑ VISCOUS[2] → STREAMLINED (An)

Molecular Theory

ED001 molecular theory (*n.*) The idea that compounds are formed of particles made of combinations of atoms (molecules). Dalton first used the term **compound atom** to describe these particles. However, he thought that gases such as hydrogen and oxygen were made of single atoms (they are elements). Gay-Lussac's Law, and some results from it, did not agree with Dalton's idea. The difficulty was resolved by Avogadro's hypothesis, which led to the idea that an element might have molecules composed of the same type of atom. Hydrogen, for example, is made up of H_2 molecules. Modern molecular theory is concerned mainly with the shapes and structure of molecules. ↓ AVOGADRO'S PRINCIPLE · BROWNIAN MOVEMENT · OSMOSIS · ISOTONIC → SURFACE TENSION · CHEMICAL BOND

ED002 Avogadro's principle (*n.*) The principle that equal volumes of gases at the same temperature and pressure contain the same numbers of molecules. It was originally stated as a hypothesis in 1811 by Amedeo Avogadro, and is often still called Avogadro's hypothesis. ↓ GAY-LUSSAC'S LAW · GRAHAM'S LAW · RAOULT'S LAW[2] ↑ MOLECULAR THEORY

ED003 Gay-Lussac's law (*n.*) When gases react they do so in volumes which bear a simple ratio to one another and to the volume of the product(s) if gaseous. All volumes are measured at the same temperature and pressure. ↑ AVOGADRO'S PRINCIPLE

ED004 Graham's law (*n.*) The rate of diffusion or effusion of a gas at a constant temperature is inversely proportional to the square root of its density.

$$\text{rate of diffusion} \propto \sqrt{\frac{1}{\text{density}}}$$

For two gases:

$$\frac{\text{rate A}}{\text{rate B}} = \sqrt{\frac{\rho_B}{\rho_A}}$$

↑ AVOGADRO'S PRINCIPLE

ED005 Raoult's law[2] (*n.*) **1** The saturated vapour pressure (s.v.p.) of one component of a mixture at a given temperature is the product of the mole fraction of that component in the liquid and the saturated vapour pressure of the component when pure and at the same temperature. Expressed in symbols it is

$$p = x p_0,$$

where p = s.v.p. of one component, x = mole fraction of the component, and p_0 = s.v.p. of pure liquid component. **2** Equimolar solutions of different non-volatile solutes in the same solvent show equal relative lowering of vapour pressure, equal elevation of boiling point, equal depression of freezing point, and equal osmotic pressures. ↑ AVOGADRO'S PRINCIPLE

ED006 Brownian movement (*n.*) When pollen grains are suspended in water or smoke particles are dispersed in air, the grains or particles are seen to be in rapid random motion. This rapid random motion is caused for the pollen grains by bombardment by water molecules, and for smoke particles by bombardment by air molecules. The movement is viewed through a microscope with side illumination. ↓ DIFFUSION · EFFUSION ↑ MOLECULAR THEORY

ED007 diffusion (*n.*) The process by which one gas mixes with another by the movement of the molecules of one gas into another and vice versa. It is also used of two miscible liquids or of a solid in contact with a solvent. The term is also used of the passage of molecules through a porous membrane. —DIFFUSE (*v.*) ↑ BROWNIAN MOVEMENT

ED008 effusion (*n.*) The escape of a gas through a small orifice from a region of higher pressure to one of lower pressure. —EFFUSE (*v.*) ↑ BROWNIAN MOVEMENT

ED009 osmosis (*n.*) The process by which solvent molecules pass through a semipermeable membrane from a dilute solution to a more concentrated solution until equilibrium is established. —***osmotic*** (*adj.*) ↓ PERMEABLE MEMBRANE · SEMIPERMEABLE MEMBRANE · OSMOTIC PRESSURE · OSMOTIC EQUATION · REVERSE OSMOSIS ↑ MOLECULAR THEORY

ED010 permeable membrane (*n.*) A membrane which allows fluids to pass through by soaking into the membrane and so passing out on the other side if there is a pressure difference. A porous pot is a permeable membrane; in a Daniell cell it allows the

electrolyte to soak through. ↑ OSMOSIS

ED011 semipermeable membrane (*n.*) A semipermeable membrane is one which allows certain ions or molecules to pass through but does not allow others to do so. Chemists tend to have a stricter definition which limits those particles which pass through to be molecules of solvent but not ions or molecules of a solute. Such semipermeable membranes are used in osmometers, *e.g.* certain varieties of cellophane, parchment, some animal membranes, and copper hexacyanoferrate (II), $Cu_2Fe(CN)_6$, are examples of membranes used. ↑ OSMOSIS

ED012 osmotic pressure (*n.*) When a solution is separated from pure solvent by a semipermeable membrane, solvent will pass through the membrane into the solution. The pressure applied to the solution just sufficient to prevent the passage of solvent is called the osmotic pressure.

Osmotic pressure (π) $\propto T$

Osmotic pressure $\propto$ concentration

↑ OSMOSIS

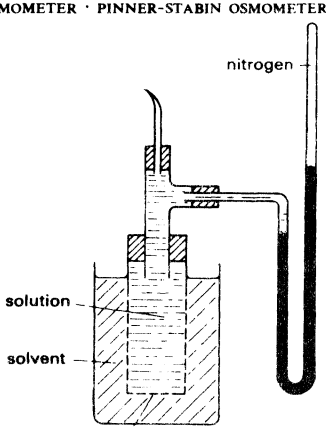
ED013 osmotic equation (*n.*) Dilute solutions (*e.g.* 1% cane sugar solutions) display some properties similar to those of gases, *e.g.* 1 mole of a solute dissolved in 22·4 dm^3 solution exerts an osmotic pressure 101 325 N m^{-2} (1 atm; 760 mm Hg.). Applying the gas equation:

$$pV = RT$$

R will have a value of 8·314 J K^{-1} mol^{-1}. This is the same as the gas constant. ↑ OSMOSIS

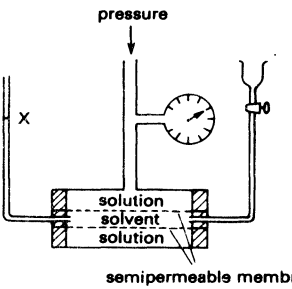
ED014 reverse osmosis (*n.*) The process used in the Berkeley-Hartley osmometer applies a pressure to stop osmosis. If the pressure is increased beyond the osmotic pressure, solvent will leave the solution and pass through to the solvent side. ↑ OSMOSIS

ED015 osmometer (*n.*) A device used for the measurement of osmotic pressure. ↓ PFEFFER'S OSMOMETER · BERKLEY-HARTLEY OSMOMETER · PINNER-STABIN OSMOMETER



PFEFFER'S OSMOMETER

ED016 Pfeffer's osmometer (*n.*) This osmometer uses a copper (II) hexacyanoferrate (II) membrane deposited in the walls of a porous pot. The solution is placed in the pot and pure solvent in a vessel outside. A pressure measuring system is attached to the solution side. The osmotic pressure is obtained from the manometer by reading the highest pressure reached. The whole apparatus is maintained at a known constant temperature. Osmotic pressures as high as 30 × 10^3 kN m^{-2} (approx 300 atm) can be measured. ↑ OSMOMETER

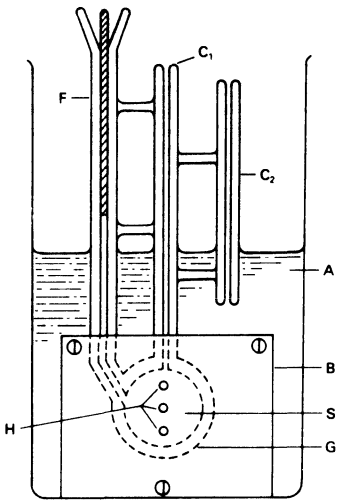


BERKELEY-HARTLEY OSMOMETER

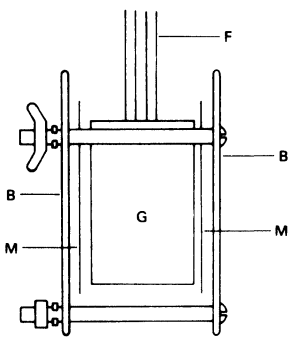
ED017 Berkeley-Hartley osmometer (*n.*) The method measures directly the pressure required to prevent osmosis. The membrane used is again copper (II) hexacyanoferrate (II). The apparatus must sustain high pressures and must therefore be suitably constructed. When a steady state is reached, the level at X remains steady. The pressure is read directly on the pressure gauge. ↑ OSMOMETER

ED018 Pinner-Stabin osmometer (*n.*) This osmometer is used for the measurement of relative molecular masses of macromolecules in solution. It is constructed of glass and stainless steel and uses specially prepared cellulose membranes. It consists essentially of a glass cylinder with a membrane on each end held and strengthened by plates perforated to allow solvent to pass through. On the barrel of the cylinder are mounted 3 tubes F is the filling tube with a levelling rod. Tube C_1 reads the osmotic pressure. Tube C_2 measures the capillary rise, since the measuring tube C_1 is of narrow bore. The cell (cylinder) is of volume 3–4 cm^3 and the membrane area 9 cm^2. The whole is placed in a tube with a stopper. Temperature control is maintained by placing the whole apparatus in a water bath. A 1% solution of a polymer of r.m.m. 100 000 will give a measurable reading of 25 mm of water or an appropriate value for some other solvent, *i.e.* approx. 250 N m^{-2} ↑ OSMOMETER

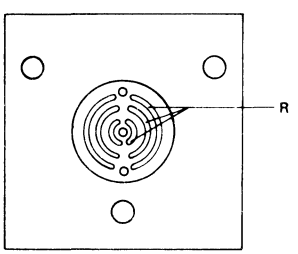
ED019 isotonic (*adj.*) Describes solutions which have the same osmotic pressure. A ·01 M solution of cane sugar and a ·01 M solution of glucose will be isotonic. ↓ HYPOTONIC · HYPERTONIC ↑ MOLECULAR THEORY



(a) experimental arrangement



(b) side view of cell



(c) detail of inside face of backing plate

A, solvent, B, backing plate; C_1, measuring capillary, C_2, capillary for measuring capillary-rise correction; F, filling tube, G, cylindrical glass cell, H, holes giving solvent access to channels on inside face of backing plate; M, membrane, S, solution, R, channels in inner face of backing plate

PINNER-STABIN OSMOMETER

ED020 hypotonic (*adj.*) Describes a solution which has a lower osmotic pressure than that of a given standard solution. ↑ ISOTONIC

ED021 hypertonic (*adj.*) Describes a solution which has a higher osmotic pressure than that of a given standard. ↑ ISOTONIC

ED022 Avogadro number (constant) (*n.*) This is the number of elementary units in one mole of a substance. The elementary unit may be an atom, molecule, ion, electron, photon, etc. The Avogadro number can be stated as the number of atoms in 0·012 kg of ^{12}C. The value usually given is $6{\cdot}022\ 52 \times 10^{23}$. Its symbol is L or N_A. ↑ MOLECULAR THEORY → RELATIVE MOLECULAR MASS

ED023 mole fraction (*n.*) Applied to a solution this means the number of moles of solute divided by the total number of moles of solute and solvent. It is a method of expressing concentrations. ↓ RELATIVE FORMULA MASS · FORMULA WEIGHT → RELATIVE MOLECULAR MASS

ED024 relative formula mass (*n.*) The mass of one mole of particles of a compound or element obtained by calculation from the formula. For example, ***a*** the relative formula mass of sodium chloride Na^+Cl^- is 58·5 g; ***b*** the relative formula mass of chlorine (Cl_2) is 71 g; ***c*** the relative formula mass of ethanol (C_2H_5OH) is 46 g. ↑ MOLE FRACTION

ED025 formula weight (*n.*) The term formerly used for RELATIVE FORMULA MASS. ↑ MOLE FRACTION

ED026 relative vapour density (*n.*) The relative vapour density of a gas or vapour is the ratio of the mass of a given volume of gas or vapour to the mass of an equal volume of hydrogen, both volumes measured at the same temperature and pressure. It can also be determined from the relation:

$$\text{relative vapour density} = \frac{\text{density of gas or vapour}}{\text{density of hydrogen}}$$

The relative vapour density is numerically equal to half the relative molecular mass of the gas or vapour. ↓ VAPOUR DENSITY[2] ↑ AVOGADRO NUMBER

ED027 vapour density[2] (*n.*) Term frequently used for RELATIVE VAPOUR DENSITY. ↑ RELATIVE VAPOUR DENSITY

ED028 surface tension (*n.*) A molecule in the surface of a liquid is acted upon by forces in the liquid but by none above the surface. There is therefore a resultant force acting upon the surface. Such forces tend to draw the surface together. In a small quantity of liquid a shape will be formed which has the smallest area (a sphere) and so produce the lowest energy state. This surface force is called surface tension. A definition may be given as 'the tangential force acting at right angles in the surface of a liquid along each unit of length of a line drawn in the surface of the liquid'. At 293 K for water it is $72{\cdot}8 \times 10^{-3}$ N m^{-1}. Surface tension usually

decreases with increase of temperature; it vanishes at the critical temperature. ↓ COHESION · CAPILLARITY · DROP · WET ↑ AVOGADRO NUMBER · MOLECULAR THEORY

ED029 cohesion (*n.*) The property of a body which makes its parts hold together, *e.g.* the molecules in water are held together by cohesion. —COHERE (*v.*) ***cohesive*** (*adj.*) ↓ ADHESION · SURFACE ENERGY · ANGLE OF CONTACT · MENISCUS

ED030 adhesion (*n.*) The interaction between two bodies which are very near to one another, *e.g.* forces of adhesion make water stay attached to the surface of glass. ↑ COHESION

ED031 surface energy (*n.*) **1** The **free surface energy** has the same value as the surface tension. It is the work done in making 1 cm^2 of surface against the cohesive forces acting on molecules at the surface (units J cm^2). For water, if γ (surface tension) is

$$72{\cdot}8 \times 10^{-3} \text{ N m}^{-1}$$

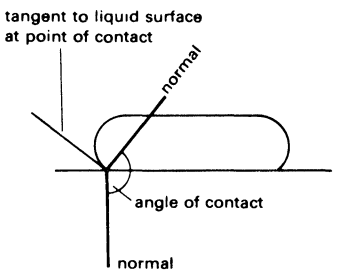
then the free surface energy will be

$$72{\cdot}8 \times 10^{-3} \text{ J m}^{-2}.$$

2 total surface energy When a surface is increased in area, work is done. If the temperature is maintained at a constant value then heat must be supplied to maintain the temperature. The total surface energy will then be:

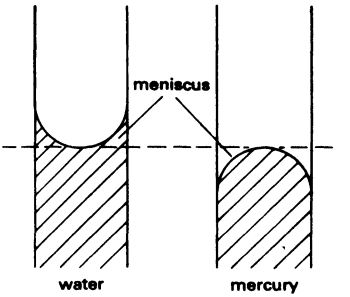
$\gamma - \frac{T d\gamma}{dT}$, $-\frac{T d\gamma}{dT}$ being the heat supplied,

$\frac{d\gamma}{dT}$ being the rate of change of surface tension with temperature.



ANGLE OF CONTACT

ED032 angle of contact *or* **contact angle** (*n.*) The angle between the normal to the liquid surface at the point at which it is to be measured, and the normal to the solid surface, or the surface of an immiscible liquid. The normal to the liquid surface is drawn into the substance of the liquid. The normal to the solid or immiscible liquid is drawn to the surface of the solid or immiscible liquid. The value of the contact angle depends on the relation between cohesion and adhesion. For mercury, cohesion is high, but adhesion for a glass surface is low; this gives a high angle (140°) of contact. For glass and water they are about equal and the angle is 0°. For water on wax, adhesion is lower than cohesion, and the angle of contact is greater than 90°. ↑ COHESION



MENISCUS

ED033 meniscus (*n.*) **1** When a liquid is enclosed in a tube the surface of the column will be curved. This curvature may be concave or convex. For mercury and glass it is convex; for water and glass it is concave. **2** The term is also used for thin lenses having one convex surface and one concave surface. ↑ COHESION

ED034 capillarity (*n.*) In narrow tubes or channels placed in water, the water rises above the outer liquid. If the tube is placed in mercury then the liquid in the tube is below the outer liquid surface. This phenomenon is called capillarity. It may be observed in tubes of diameter less than about 1 mm. The term is in fact a descriptive term for some effects caused by surface tension. ↓ CAPILLARY TUBE · CAPILLARY RISE · CAPILLARY DEPRESSION · CAPILLARY ATTRACTION ↑ SURFACE TENSION

ED035 capillary tube (*n.*) A tube of very narrow bore, usually approximately 0·5 mm. This can have a thick wall especially made, or made by drawing out a piece of glass tubing. ↑ CAPILLARITY

ED036 capillary rise (*n.*) The height to which a liquid, such as water, rises in a glass capillary tube. In the case of water the rise is

$$h = 2\gamma/r\rho g$$

where r is the radius of the tube, γ is the surface tension of the liquid, ρ the density of the liquid, and g the acceleration due to gravity. ↑ CAPILLARITY

ED037 capillary depression (*n.*) The measure of the lowering of a liquid surface in a capillary tube. Such a capillary depression occurs with mercury. It is given by the same expression as for capillary rise. ↑ CAPILLARITY

ED038 capillary attraction (*n.*) Capillary rise or depression implies some attractive force which draws the surface up or down. The force arises from a pressure difference above and below the surface in the tube which is equal to $\frac{2\gamma}{r}$, r being the radius of curvature of the meniscus which approaches very closely to the radius of the tube, and γ

the surface tension of water. If, as in the case of mercury, the meniscus is concave, r will have a negative value and the attraction will act in the opposite direction. Consider also the energy arising from wetting the walls of the tube. The solid has surface energy because of asymmetric forces. If the surface is wetted the asymmetry is reduced and so is its surface energy. This energy is used in raising the liquid. ↑ CAPILLARITY

ED039 drop (*n.*) A drop forms because an isolated amount of liquid tends to form into a shape which has a minimum surface, thereby reducing its surface energy. As the volume of liquid increases gravitational forces cause a flattening out. Whether drops form on a solid surface will depend upon the angle of contact the liquid makes with the surface. This in turn depends on the balance of surface energies for solid surface, liquid surface, and solid surface covered with liquid. If aniline is dropped into water from a separating funnel, a spherical drop will be formed. ↓ FILM · GASEOUS FILM · CONDENSED FILM · MONOLAYER · FILM PRESSURE · BUBBLE[2] ↑ SURFACE TENSION

ED040 film (*n.*) A film is a thin layer. It may be one liquid on another, a liquid on a solid or a gas/vapour on a solid. The liquid usually considered is water and the film producing substance is often a fatty acid or alcohol. Such layers may be as thin as one molecule (a **monolayer**). The films so formed exert a force per unit length called **film pressure**. Sometimes, if the liquid surface is large and the amount of spreading material small, the film may be so diffuse as to resemble a gas in two dimensions. Films may be gaseous films, condensed films, liquid expanded films, or vapour expanded films. Film formation will depend upon the balance of surface tensions air/water γ_1; film/water γ_2; film/air γ_3. If $\gamma_3 + \gamma_1 > \gamma_2$ there will be a film, as opposed to a drop or lens. ↑ DROP

ED041 gaseous film (*n.*) When a film is very diffuse molecules are so far apart that there is no film pressure. As the molecules draw close together their collisions are similar to those in a gas and the effect is the same as pressure but in two dimensions. At a low concentration film pressure obeys a law similar to the Gas Law. It is:

$$pA = nkT$$

p = film pressure, A = area of film, k = Boltzmann constant, T = absolute temperature, n = number of molecules. Such a film is called a gaseous film. ↑ DROP

ED042 condensed film (*n.*) As the surface area of a gaseous film is reduced the molecules collect in groups. The curve for area against film pressure resembles the flattening in the Andrews curves for carbon dioxide. Such a film is called a condensed film. Films of fatty acids and alcohols form condensed films readily. ↑ DROP

ED043 monolayer (*n.*) A condensed film one molecule thick is called a monolayer or monomolecular layer. ↑ DROP

ED044 film pressure (*n.*) The force per unit length exerted by a monomolecular film on the surface of a liquid (usually water). The units are newtons per metre. ↑ DROP

ED045 bubble[2] (*n.*) A liquid with a plane surface has the same pressure on the two sides of its interface. If the pressure on one side of the surface increases, the surface becomes curved. A curved liquid surface has a pressure difference on its two sides. If the liquid is in the form of a drop, *i.e.* the interface is a minimum and continuous, the pressure difference will be :

$$p = \frac{2\gamma}{r}$$

r = radius of bubble or drop (or radius of curvature of a curved surface). For a soap bubble air/liquid/air:

$$p = \frac{4\gamma}{r}$$

γ is in N m^{-1} and therefore p is in N m^{-2}. ↑ DROP

ED046 wet (*v.t.*) (Of a liquid) to spread over a solid surface. Liquids of low surface tension tend to do this although the solid surface is an important factor. Water wets clean glass but does not wet a wax surface. Solutions have lower surface tensions than the pure solvent Certain solutes aid wetting. When a liquid wets a solid the angle of contact is zero. ↑ SURFACE TENSION → WETTING AGENT

Kinetic Theory

EE001 kinetic theory (*n.*) A theory which provides a model of matter consisting of particles in motion. To these particles in motion are applied the principles of mechanics. The theory has proved especially useful as applied to gases but may also be extended to explain some of the properties of liquids and solids The theory sets out the following underlying principles.

1 Matter consists of particles which may be atoms, molecules, or ions.

2 The particles are separated by distances which are large in comparison with their size While distances may be great in gases, they are less in liquids and less still in solids

3 Particles are considered to be in continual motion, although the type of motion varies in gases, liquids and solids. In solids there is no motion of translation. In gases and liquids translatory motion is random and

collisions between particles are considered perfectly elastic.
4 The pressure of a gas is thought of as arising from bombardment of the walls of a containing vessel.
5 The kinetic energy of a particle is a measure of its temperature.
6 The average kinetic energy of all the particles is considered constant for a given temperature: $^1/_2\ mu^2 \propto T$.
↓ KINETIC EQUATION · GAS LAWS · HUMIDITY

EE002 kinetic equation (*n.*) Using the assumptions of kinetic theory and the principles of mechanics, a general equation for gases may be derived:

$$pV = {}^1/_3\ mnu^2$$

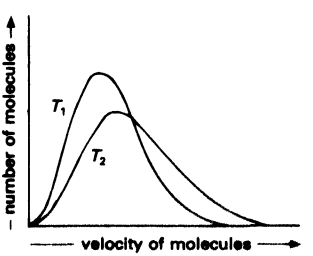
p being the pressure exerted by the gas, V the volume, m the mass of 1 molecule, n the number of molecules present, u the root mean square velocity. Using this equation, the gas laws as they apply to ideal gases may be derived. ↓ ROOT-MEAN-SQUARE VELOCITY · MAXWELL'S DISTRIBUTION LAW · MEAN FREE PATH

EE003 root – mean – square velocity A method of arriving at an average value for velocities of particles (and also other values). If individual particles have velocities u_1, u_2, u_3, etc. . . . . u_n, then the root mean square velocity

$$u = \sqrt{\frac{u_1^2 + u_2^2 + u_3^2 \ldots . u_n^2}{n}}$$

The value for average particle velocity is u and the average kinetic energy per particle (per molecule) is $^1/_2\ mu^2$. ↑ KINETIC EQUATION

EE004 Maxwell's distribution law (*n.*) A law derived by Clerk Maxwell for the distribution of molecular velocities in a gas at a given temperature. The diagram below shows such distributions graphically for different temperatures. The higher the temperature the more scattered the distribution.



MAXWELL'S DISTRIBUTION LAW

The distribution of kinetic energy follows the same pattern. The equation

$$n = n_0 e^{-E/RT}$$

indicates the number (n) of molecules (out of a total n_0 molecules) which have kinetic energy greater than E. ↑ KINETIC EQUATION

EE005 mean free path (*n.*) The mean distance a molecule moves between consecutive collisions. The expression

$$l = \eta\sqrt{\frac{3}{p\rho}}$$

gives a value for the mean free path of a gas in terms of η the viscosity, p the pressure, and ρ the density. The value for hydrogen is 11·23 μm. ↑ KINETIC EQUATION

EE006 gas laws (*n.pl.*) Empirical generalizations on the behaviour of gases. The fundamental laws are those of Boyle and Charles. To this may be added Dalton's law of partial pressures. ↓ BOYLE'S LAW · GAS EQUATION · CRITICAL TEMPERATURE → KINETIC THEORY · SPECIFIC HEAT CAPACITY OF GASES

EE007 Boyle's law (*n.*) The volume of a given mass of gas is inversely proportional to the pressure, if the temperature remains constant. It is now known that the law does not hold for high values of p for real gases. The law may be expressed as $pV = k$, where k is a constant for all gases at a given temperature. Boyle's Law has now become a definition of an ideal gas. ↓ CHARLES' LAW · DALTON'S LAW · COEFFICIENT OF EXPANSION ↑ GAS LAWS

EE008 Charles' law (*n.*) The volume of a given mass of gas changes by $^1/_{273}$ of its volume at 0°C for each degree Celsius rise or fall of temperature, if the pressure remains constant. This can be expressed as:

$$V_\theta = V_0\,(1 + \theta/273)$$

This may be reduced to a form $V \propto T$, or

$$\frac{V_\theta}{V_0} = \frac{T_\theta}{273} \text{ or } \frac{V_1}{V_2} = \frac{T_1}{T_2}$$

where T_1 and T_2 are points on the absolute scale. ↑ BOYLE'S LAW

EE009 Dalton's law (*n.*) The total pressure exerted by a mixture of gases, which do not interact, is the sum of the pressures which each gas would exert if it were present alone in the entire volume occupied by the gas, *e.g.* for a wet gas, *i.e.* one collected over water:

$$\text{the pressure of wet gas} = \text{pressure of dry gas} + \text{pressure of water vapour}$$

The pressure of water vapour at any given temperature can be obtained from tables, therefore the pressure of dry gas can be

calculated. The pressures of each gas separately are called the partial pressures of the gas. Also called ***Dalton's law of partial pressures.*** ↑ BOYLE'S LAW

EE010 coefficient of expansion of a gas at constant pressure The coefficient is the fraction of its volume at 0°C by which the volume of a fixed mass of gas increases by 1°C rise in temperature, the pressure remaining constant. This is an alternative way of expressing Charles' law, in which the coefficient is $^1/_{273}$. ↑ BOYLE'S LAW

EE011 pressure coefficient of expansion of a gas at constant volume This coefficient is the fraction of the pressure of a gas at 0°C by which the pressure of a fixed mass of gas increases for 1°C rise in temperature when the volume remains constant. ↑ BOYLE'S LAW

EE012 pressure law (*n.*) A law which corresponds to Charles' law for volume change with temperature, while pressure is constant. It can be stated as—
The pressure of a fixed mass of gas at constant volume increases by $^1/_{273}$ of its pressure at 0°C for one °C rise in temperature. ↑ BOYLE'S LAW

EE013 isothermal expansion (*n.*) The expansion of a given mass of gas without change of temperature. If a perfect gas expands against a reversible resistance, heat must be supplied to maintain a constant temperature, and vice-versa. The process is represented as:

$$pV = k$$

A plot of p against V will be a rectangular hyperbola. ↑ BOYLE'S LAW

EE014 adiabatic expansion (*n.*) An expansion of a gas in which no heat enters or leaves the gas during expansion. An adiabatic expansion must lead to a fall in temperature and an adiabatic compression must lead to a rise in temperature. The equation connecting p and V for an adiabatic change is pV^γ = constant, where γ is the ratio c_p/c_V. c_p is specific heat capacity of the gas at constant pressure; c_V specific heat capacity of the gas at constant volume. An adiabatic change is one during which the entropy of the system remains constant. ↑ BOYLE'S LAW

EE015 gas equation (*n.*) The equation for Boyle's law and Charles' law can be combined into a general equation $pV = nRT$, where R is constant—usually called the gas constant, and n is the number of moles of gas. ↓ VAN DER WAALS EQUATION · MOLAR GAS CONSTANT · BOYLE TEMPERATURE ↑ GAS LAWS

EE016 van der Waals equation (*n.*) The kinetic theory makes certain assumptions. It proposes to treat the volume of the gas molecules as negligible compared with the total volume and this affects the measure of volume of the gas. It also does not take account of the cohesive forces between the molecules. The cohesive force of one molecule on another results in an inward pull at the surface of the containing vessel. Van der Waals modified the gas equation to compensate for molecule size and intermolecular cohesion. The resulting equation is: $(p + a/V^2)(V - b) = RT$ (for 1 mole of gas). The values of a and b are constants for any one gas. ↑ GAS EQUATION

EE017 molar gas constant (*n.*) The constant R in the gas equation $pV = nRT$. It can be found by putting in the values of p, V, and T for 1 mole of gas at standard temperature and pressure. Thus: $n = 1$, $p = 101\,325$ N m^{-2}, $V = 22.4$ dm^3, and $T = 273$ K. R is 8·3143 J K^{-1} mol^{-1}. It is possible to express R in other units, *e.g.* formerly it was 2 calorie K^{-1} mol^{-1} or 0·082 dm^3 atm K^{-1} mol^{-1}. This latter is useful when the equation is applied to dilute solutions. ↑ GAS EQUATION

EE018 Boyle temperature (*n.*) That temperature at which a gas most closely obeys Boyle's law. It is the point at which a graph of pV against p is horizontal. ↑ GAS EQUATION

EE019 critical temperature (*n.*) That temperature above which a gas cannot be liquefied no matter how high the pressure, *e.g.* the critical temperature for oxygen is −119°C but for carbon dioxide it is 31°C. Oxygen can only be liquefied if cooled below −119°C but carbon dioxide can be liquefied at room temperature. Critical temperature is usually given the symbol T_c. ↓ CRITICAL PRESSURE · CRITICAL VOLUME · ANDREW'S ISOTHERMALS · INVERSION TEMPERATURE ↑ GAS LAWS

EE020 critical pressure (*n.*) The pressure which is just sufficient to liquify a gas at its critical temperature. It can also be described as the saturated vapour pressure of a liquid at its critical temperature. It has THE SYMBOL p_c. ↑ CRITICAL TEMPERATURE

EE021 critical volume (*n.*) The volume occupied by a given mass of gas at its critical temperature and pressure. If the amount of gas is one mole then the volume is the molar critical volume. ↑ CRITICAL TEMPERATURE

EE022 critical density (*n.*) The density of a gas at its critical temperature and pressure, *e.g.* for oxygen $T_c = 154{\cdot}2$ K, $p_c = 49{\cdot}7$ atm, and the critical density $\rho_c = 0{\cdot}430$ kg m^{-3}. ↑ CRITICAL TEMPERATURE

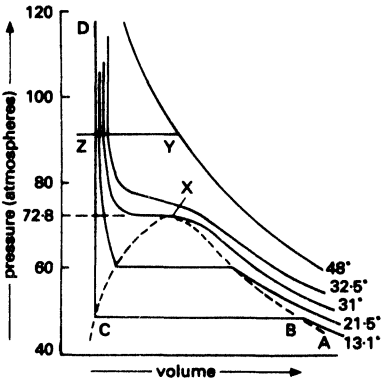
EE023 critical constants (*n.*) These are the critical temperature (T_c), the critical pressure (p_c) critical density (ρ_c) and molar critical volume. They are constant for any one gas. ↑ CRITICAL TEMPERATURE

EE024 critical point (*n.*) The point at which a gas is at its critical temperature and pressure. ↑ CRITICAL TEMPERATURE

EE025 critical isothermal (*n.*) The isothermal relating the volume and pressure of a gas at its critical temperature. ↑ CRITICAL TEMPERATURE

EE026 Andrews' isothermals (*n.*) In 1869 Thomas Andrews carried out extensive researches into the behaviour of carbon

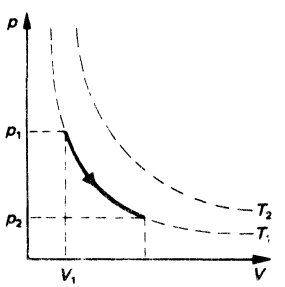
dioxide. The set of isothermals he produced bears his name. They are shown below.



ANDREWS' ISOTHERMALS

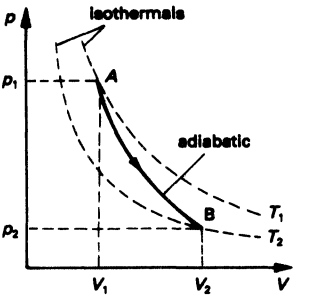
X marks the critical point for carbon dioxide. The almost vertical part Z shows the very small compressibility of liquids. The horizontal lines represent the liquefaction of the gas. Volume changes without change of pressure, *i.e.* a liquid in contact with its saturated vapour. The 48°C isothermal represents a gas above its critical temperature. ↑ CRITICAL TEMPERATURE

EE027 corresponding states (*n.*) If the values of T, p, and V for a gas are expressed as a fraction of the corresponding critical values T_c, P_c, and V_c, the results θ, π, and φ are known as the reduced states. When substances have the same reduced T, p, and V, they are in corresponding states. ↑ CRITICAL TEMPERATURE



ISOTHERMAL

EE028 isothermal (*n.*) A curve of pressure against volume for a substance at a fixed temperature. As the internal energy of a perfect gas depends only on temperature, isothermals are also curves of equal internal energy. ↓ ADIABATIC · JOULE-THOMSON EFFECT · INVERSION TEMPERATURE ↑ GAS LAWS → SPECIFIC HEAT CAPACITY OF A GAS · LATENT HEAT · INTERNAL ENERGY



ADIABATIC

EE029 adiabatic (*n.*) A curve of pressure against volume representing an adiabatic change. These lines always slope more steeply than the isothermals that they cross. □ *adiabatics are curves of equal entropy* ↑ ISOTHERMAL

EE030 Joule-Thomson effect (*n.*) Change in temperature of a gas when it is expanded quickly. It can be shown by allowing gas at high pressure to flow through a porous plug into a region of low pressure. Most gases at ordinary temperatures show a fall in temperature, but hydrogen shows a rise. At sufficiently low temperatures hydrogen also shows a fall. ↑ ISOTHERMAL

EE031 inversion temperature (*n.*) The temperature at which, for a given gas, there is no Joule-Thomson effect. Below the inversion temperature there is a cooling effect. Above the inversion temperature there is a heating effect. For helium the inversion temperature is 25 K; for nitrogen it is 650 K. ↑ ISOTHERMAL

EE032 change of state (*n.*) The change from solid to liquid, solid to vapour, or liquid to vapour; the reverse processes are also called changes of state. ↓ MELTING · CONDENSATION[1] · EVAPORATE[1] · SOLIDIFY[1] → KINETIC THEORY

EE033 melting (*n.*) The process of changing from a solid to a liquid, *e.g.* the melting of naphthalene is brought about by placing a tube of the solid in a waterbath at a temperature of approximately 80°C. ↓ EVAPORATION · BOILING[2] · BOILING POINT ↑ CHANGE OF STATE

EE034 evaporation (*n.*) The process of changing a liquid into a vapour, usually by applying heat, or by the liquid taking heat from its surroundings. During this process the bulk of the liquid is reduced □ *evaporation to dryness; concentration by evaporation* —EVAPORATE (*v.*) ↑ MELTING

EE035 boiling[2] (*n.*) The process that takes place in a liquid when it boils. —BOIL (*v.*) BOILING (*adj.*) ↑ MELTING

EE036 boiling point (*n.*) The temperature at which the vapour pressure of a liquid is equal to the pressure of the atmosphere. At the boiling point, evaporation is visible throughout the liquid. ↑ MELTING

EE037 condensation[1] (*n.*) The process of forming a liquid from its vapour. —CONDENSE (*v.*) ↑ MELTING

EE038 liquefaction (*n.*) The process by which a solid or a gas becomes a liquid. The liquefaction of a gas is brought about by cooling and by pressure. —LIQUEFY (*v.*) ↑ CONDENSATION

EE039 freezing mixture (*n.*) Usually a mixture of ice and salt or other suitable substances which brings about a rapid and appreciable fall in temperature below that of room temperature. Some common freezing mixtures are: ice and salt (−21°C); ethanol and solid carbon dioxide (−72°C); sodium thiosulphate crystals in water (−8°C).

EE040 melting point (*n.*) The temperature at which solid and liquid phases of a substance can exist together in equilibrium at standard pressure 101 325 N m^{-2}. Melting point is used of substances which are solid at room temperature, *e.g.* the melting point of lead is 327·3°C. ↑ CONDENSATION[1]

EE041 freezing point (*n.*) The same temperature as for melting point, but freezing point is used of substances which are liquid at room temperature, *e.g.* the freezing point of water is 0°C (temperature at which ice and water are in equilibrium at a pressure of 101 325 N m^{-2}). ↑ CONDENSATION[1]

EE042 melt[1] (*v.i.*) (Of a solid) to change from the solid state to the liquid state. This is usually done by heating the solid to a sufficiently high temperature, *e.g.* ***a*** sodium chloride melts at 800°C; ***b*** ice melts at 0°C. —MELT (*n.*) ***molten*** (*adj.*) ↓ MELT[2] · LIQUEFY · SOLIDIFY[2] (Cn) · FREEZE (Cn) ↑ CHANGE OF STATE

EE043 melt[2] (*v.t.*) To cause a solid to melt. A solid can be melted by heating it to a sufficiently high temperature, *e.g.* when sodium chloride is heated to 808°C, it is melted. ↑ MELT[1]

EE044 liquefy (*v.t.*) To change a substance from a solid or a gas to the liquid state, *e.g.* a gas is liquefied by cooling and by pressure. —LIQUEFACTION (*n.*) LIQUID (*adj.*) ↓ SOLIDIFY[1] (Cn) · VAPORIZE[1] (Cn) ↑ MELT[1]

EE045 molten (*adj.*) Describes a substance in the liquid state, which is found in the solid state at room temperature, *e.g.* ***a*** sodium chloride has a melting point of 808°C. Above that temperature it is molten; ***b*** an ionic compound in the molten state conducts electricity. ↑ CHANGE OF STATE

EE046 evaporate[1] (*v.t.*) To change a liquid into vapour and so reduce the bulk of the liquid. This is usually done by heating the liquid □ *to evaporate a liquid to dryness* —EVAPORATION (*n.*) ***evaporated*** (*adj.*) ↓ EVAPORATE[2] · VAPORIZE[1] · VAPORIZE[2] · CONDENSE[1] (Cn) ↑ CHANGE OF STATE → BOIL · SUBLIME

EE047 evaporate[2] (*v.i.*) When a liquid loses high energy molecules from its surface, slowly changing to vapour, it evaporates, *e.g.* ether evaporates if left in an unstoppered vessel. ↑ EVAPORATE[1]

EE048 vaporize[1] (*v.t.*) To cause a liquid to vaporize, *e.g.* by raising its temperature, by decreasing the pressure upon it, or mechanically by blowing air through it (of volatile liquids, such as ether). —***vaporization*** (*n.*) ↑ EVAPORATE[1]

EE049 vaporize[2] (*v.i.*) A liquid vaporizes when it changes into vapour. Some solids, such as camphor and naphthalene, vaporize in air. —VAPOUR, ***vaporization*** (*n.*) ↑ EVAPORATE[1]

EE050 condense[1] (*v.t.,i.*) **1** (*v.t.*) To change a vapour into liquid by cooling or by increased pressure, or by both. **2** (*v.i.*) (Of a vapour) to change into a liquid because of cooling or increased pressure, or both. The most usual method is by cooling and applies to those substances which are liquid at room temperature. —CONDENSE, ***condensation*** (*n.*) ↑ EVAPORATE[1,2]

EE051 solidify[1] (*v.t.*) To cause a substance which is in the liquid state (molten) to become solid, usually by cooling. ↓ SOLIDIFY[2] · FREEZE · SET[3] ↑ CHANGE OF STATE

EE052 solidify[2] (*v.i.*) To change from the liquid state to the solid state; the term is used of substances which are normally solid at room temperature. —SOLID (*n.*) ***solidification*** (*n.*) SOLID (*adj.*) ↑ SOLIDIFY[1] · FREEZING POINT · MELTING POINT

EE053 freeze (*v.t.,i.*) **1** (*v.i.*) (Of substances which are in the liquid state at room temperature) to change from the liquid to the solid state, *e.g.* ***a*** water (liquid) freezes to become ice (solid); ***b*** liquid mercury freezes at −39°C. **2** (*v.t.*) To cause to change from the liquid to the solid state. —***frozen*** (*adj.*) ↑ SOLIDIFY[1] · LIQUEFY (Cn) · MELT[1,2] (Cn)

EE054 set[3] (*v.i.*) **1** A suspension of solids in a liquid medium sets to a solid as the liquid (or solvent) evaporates, *e.g.* ***a*** cement sets to a solid as it dries out; ***b*** a hot colloidal sol sets to a gel on cooling □ *plaster of Paris sets to the shape of a mould* ↑ SOLIDIFY[1] (Sn) · FREEZE (Sn)

EE055 humidity (*n.*) A measure of the extent to which the atmosphere contains moisture (water vapour). —***humify*** (*v.*) ***humid, humidified*** (*adj.*) ↓ SATURATION VAPOUR PRESSURE · COOLING BY EVAPORATION · HUMIDITY CONTROL · HUMIFIED · HYGROMETRY → KINETIC THEORY

EE056 saturation vapour pressure (*n.*) When there is a state of dynamic equilibrium between a liquid and its vapour at a given temperature the vapour is said to be saturated. The partial pressure exerted by the vapour is called the saturation vapour pressure. ↓ ABSOLUTE HUMIDITY · RELATIVE HUMIDITY · DEW · DEW POINT ↑ HUMIDITY

EE057 absolute humidity (*n.*) The mass of water present in a unit volume of air. ↑ SATURATION VAPOUR PRESSURE

EE058 relative humidity (*n.*) The mass of water in a given volume of air divided by the mass of water vapour required to saturate the air at the temperature considered. Alternatively, it is the saturation vapour

pressure of water at the dew point divided by the saturation vapour pressure at the temperature of the air. Relative humidity can be expressed as a fraction or a percentage. ↑ SATURATION VAPOUR PRESSURE

EE059 dew (*n.*) When the air contains water vapour and the temperature slowly falls (as at night) the air finally becomes saturated with water vapour. Any further cooling causes deposition of drops of water on suitable surfaces, *e.g.* leaves, blades of grass, and so on. This moisture is called dew. ↑ SATURATION VAPOUR PRESSURE

EE060 dew point (*n.*) The temperature at which the water vapour present in a sample of air is enough to saturate that sample. It is the temperature at which dew forms. Dew can be artificially made to deposit on a surface by cooling the surface, or by cooling the air which contains the moisture beyond saturation. ↑ SATURATION VAPOUR PRESSURE

EE061 cooling by evaporation (*n.*) If an evaporating basin with water in it is left in the air some of the water changes to vapour. This process will depend upon, ***a*** the humidity of the air; ***b*** the specific latent heat of water. If the air is 100% saturated with water vapour then no water vapour will evaporate from the basin. If the air is very dry, say 10% humidity, then evaporation will readily take place. The change $H_2O_{(l)} \rightarrow H_2O_{(g)}$ involves the absorption of heat. The heat may be supplied by an independent source or it may be taken from the surroundings. Evaporation will therefore, in the absence of supplied heat, cause cooling. The passing of air which moves away layers saturated with moisture aids the cooling process. ↓ MIST · FOG · CLOUD ↑ HUMIDITY

EE062 mist (*n.*) A large collection of very small water drops. They are usually produced when warm moist air is in contact with the cold ground. Mist is often formed at night, the land having cooled quickly, especially on a clear night when there are no clouds to reduce loss by radiation. Morning mists are common where humidity is high and clear skies usual. In a mist visibility should not be less than 1000 m. A mist disappears rapidly as the temperature rises. —***mistiness*** (*n.*) ***misty*** (*adj.*) ↑ COOLING BY EVAPORATION

EE063 fog (*n.*) The distinction between **mist** and **fog** is in the first place one of visibility. If the visibility falls below 1000 m mist becomes a fog. The presence of fine dust and soot particles in the air increases precipitation of water droplets in a very humid air to make the fog more persistent and dense. The fog then becomes a colloid system, with air as the dispersion medium and water as the dispersed phase. This system is stabilized by the charge on the droplets. —***foggy*** (*adj.*) ↑ COOLING BY EVAPORATION

EE064 cloud (*n.*) A mass of very small water droplets or ice crystals. Warm moist air rises from the Earth's surface. In rising it expands and therefore cools. On reaching its dew point water droplets appear. As the air rises the top of the cloud will be ice crystals. Wind from the sea will bring air of high humidity (moisture-laden air). This rises rapidly overland forming cloud. Compare the difference between the following ways of using this term, *e.g.* ***a*** there is a lot of cloud today; ***b*** there were not many clouds yesterday. ↑ COOLING BY EVAPORATION

EE065 humidity control (*n.*) In buildings where people work it is necessary to maintain humidity conditions between desired limits. Depending upon the local conditions it may be necessary either to add or remove moisture. Moisture may be added by sprays of water or jets of steam into the air circulation system. Moisture is more usually removed by passing the air through a cooling device, *e.g.* a refrigerating unit. This will cause deposition of moisture. The air so treated is then passed into the circulation system. The process may be controlled by a recording hygrometer set to activate the system if conditions depart from a determined norm. ↓ AIR CONDITIONING[1] ↑ HUMIDITY

EE066 air conditioning[1] (*n.*) This is a general term which includes purification, humidity, and temperature control, of air in a building to ensure safe and comfortable conditions for effective living and working. ↑ HUMIDITY CONTROL

EE067 humified (*adj.*) Describes air to which water vapour has been added to increase its humidity. —HUMIDITY (*n.*) ***humify*** (*v.*) ***humid*** (*adj.*) ↑ HUMIDITY · HUMIDITY CONTROL

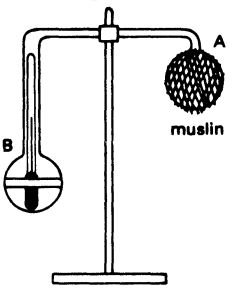
EE068 hygrometry (*n.*) The study of the measurement of the humidity of the air. The instrument for making such measurement is called a hygrometer. The types of hygrometer are: ***a*** chemical; ***b*** dew point; ***c*** wet and dry bulb; ***d*** recording. —***hygrometer*** (*n.*) ↓ CHEMICAL HYGROMETER · DEW-POINT HYGROMETER · WET AND DRY BULB HYGROMETER · RECORDING HYGROMETER ↑ HUMIDITY → KINETIC THEORY

EE069 chemical hygrometer (*n.*) An apparatus for measuring absolute and relative humidity. The mass of water vapour present in a given volume of air is obtained. The mass of water vapour required to saturate the same volume of air is also obtained. A known volume of air is passed through a series of weighed drying tubes containing phosphorus (V) oxide as the drying agent. These are weighed again after the required volume has passed through. The exercise is repeated using air saturated with water vapour. ↓ HYGROSCOPE ↑ HYGROMETRY

EE070 hygroscope (*n.*) A device for making qualitative assessments of humidity, *e.g.* ***a*** a bunch of seaweed; ***b*** a piece of paper soaked in cobalt nitrate or chloride solution and then dried (colour change pink to blue); ***c*** a human hair or other fibre which increases in length with increased humidity ↑ CHEMICAL HYGROMETER

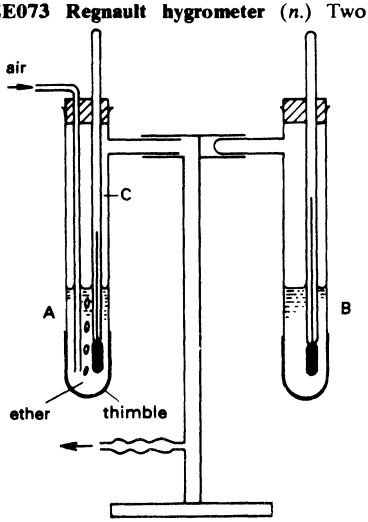
EE071 dew-point hygrometer (*n.*) A type of hygrometer which depends for its action on the determination of the dew point. At the dew point the air is saturated with water vapour. This gives a value of the partial pressure of water vapour in the air. The relative humidity is the saturation vapour pressure at the dew point divided by the saturation vapour pressure at air temperature. Knowing the temperatures, the pressures can be read from tables. ↓ DANIELL HYGROMETER · REGNAULT HYGROMETER · MOSS HYGROMETER · DINES HYGROMETER

EE072 Daniell hygrometer (*n.*) The hygrometer is constructed as in the diagram. Two bulbs are connected with a tube. Bulb A is covered in muslin and soaked in ether. The ether evaporates, cooling bulb A. The pressure is reduced and this causes evaporation in B. This evaporation causes cooling and eventually dew forms on B. The temperature of the thermometer in B gives the dew point. Another thermometer is usually attached to the support to give the temperature of the air. ↑ DEW POINT HYGROMETER



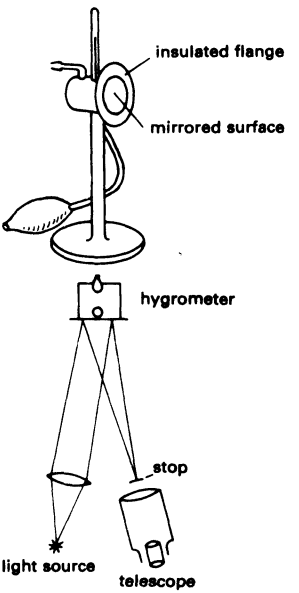
DANIELL HYGROMETER

EE073 Regnault hygrometer (*n.*) Two tubes of similar dimensions with silver thimbles fitted at the end are set side by side Air is blown through ether in A to speed evaporation. This cools the thimble on A. When dew forms, the temperature shown by thermometer C is the dew point. The temperature in B gives the air temperature at the time. ↑ DEW POINT HYGROMETER



REGNAULT HYGROMETER

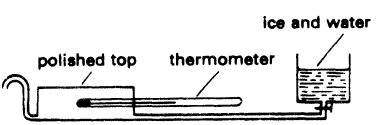
EE074 Moss hygrometer (*n.*) A hygrometer depending on ether-evaporation cooling. In this case a metal box is used with a face which has a mirrored surface.



MOSS HYGROMETER

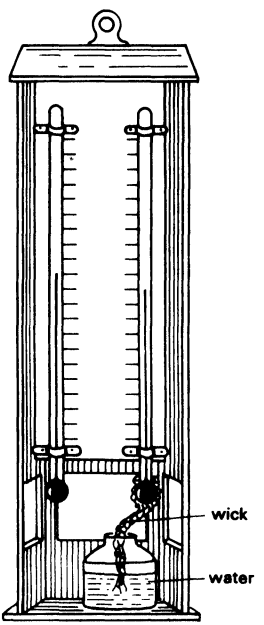
A flange around the mirror surface is insulated from the cooled area. This gives an easy comparison system. A thermometer in the metal box records the dew point. Temperature may be measured by a thermocouple and the mirror surface may be examined by reflection of a beam of light. When the surface is all clear an image of the light source will be formed. When dew forms diffuse reflection from the cold part will distort the image. ↑ DEW POINT HYGROMETER

EE075 Dines hygrometer (*n.*) In this hygrometer a flow of ice-cooled water flows through a metal box, the surface of which is polished. A thermometer records the temperature in the box. The water flow can be controlled. ↑ DEW POINT HYGROMETER



DINES HYGROMETER

EE076 wet and dry bulb hygrometer (*n.*) This type of hygrometer depends again upon the cooling effect of evaporation. There is, however, a difference. An equilibrium is set up between $H_2O_{(l)} \rightleftharpoons H_2O_{(g)}$ at the surface of the wet thermometer and the water vapour already present in the air. If the air is very damp then very little evaporation takes place. If the air is very dry a lot of evaporation takes place. An equilibrium is set up. The hygrometer consists of two thermometers: one, the dry, recording the air temperature; the other, the wet, is surrounded by a piece of muslin which dips like a wick into a reservoir of water. The wet bulb temperature is always higher than the dew point. Tables for wet and dry bulb temperatures give the relative humidity. ↓ PSYCHROMETER · MASON PSYCHROMETER · ASSMAN PSYCHROMETER · GLAISHER FACTOR



WET AND DRY BULB HYGROMETER

EE077 psychrometer (*n.*) A hygrometer in which a strong draught is set up past wet and dry bulbs. This may be by whirling it at the end of a cord or by artificial means. ↑ WET AND DRY BULB HYGROMETER

EE078 Mason psychrometer (*n.*) A type of wet and dry bulb hygrometer; it must have a current of air of speed 1 to 1·5 m s^{-1} blown past it. ↑ WET AND DRY BULB HYGROMETER

EE079 Assman psychrometer (*n.*) A type of psychrometer in which the draught is maintained by a fan. ↑ WET AND DRY BULB HYGROMETER

EE080 Glaisher factor (*n.*) A factor given by the ratio:

$$\frac{\text{air temperature} - \text{dewpoint temperature}}{\text{dry bulb reading} - \text{wet bulb reading}}$$

↑ WET AND DRY BULB HYGROMETER

EE081 recording hygrometer (*n.*) An instrument which records on a suitably printed sheet a continuous record of humidity; such instruments need to be calibrated. ↓ HAIR HYGROMETER · ELECTRIC HYGROMETER ↑ HYGROMETRY

EE082 hair hygrometer (*n.*) Human hair increases in length by 3 per cent if the humidity increases from a small value to complete saturation. This increase can be multiplied by suitable mechanical devices. The device may have a pointer moving on a scale. Alternatively a recording pen can be operated on a piece of graph paper on a drum. The instrument must be calibrated. ↑ RECORDING HYGROMETER

EE083 electric hygrometer (*n.*) A type of hygrometer that depends upon the fact that lithium chloride is hygroscopic and that increase of humidity is followed by a change in resistance of a thin film of the substance. This type of instrument gives a rapid response to humidity changes. ↑ RECORDING HYGROMETER

Chromatography

EF001 partition[2] (*n.*) The distribution of a solute between two solvents which are immiscible. The solute must be soluble in both solvents, *e.g.* iodine is slightly soluble in water and quite soluble in benzene. If a solution of iodine in water is shaken with benzene, the iodine will be distributed between the two separate layers. —PARTITION (*v.*) ↓ PARTITION LAW · PARTITION COEFFICIENT · COUNTERCURRENT DISTRIBUTION

EF002 partition law (*n.*) When a solute is soluble in two immiscible solvents, X and Y, the solute distributes itself between the solvents according to the law:

$$\frac{\text{concentration of solute in X}}{\text{concentration of solute in Y}} = \text{constant}$$

The constant, at a given temperature, is called the **partition coefficient.** ↓ PARTITION COEFFICIENT · CHROMATOGRAPHY ↑ PARTITION[2]

EF003 partition coefficient (*n.*) The ratio of the concentrations of a solute in two immiscible solvents, distributed according to the partition law. ↑ PARTITION LAW

EF004 countercurrent distribution (*n.*) An automatic procedure for separating closely related solutes by making use of their slightly different partition coefficients in two immiscible solvents. The heavier solvent is placed in a number of tubes (100—200). The sample is dissolved in the lighter solvent and placed in tube 1, shaken and allowed to settle. The upper solvent is transferred automatically to tube 2. A new portion of the lighter solvent is added to 1. The process goes on; both solvents are transferred along the line of tubes and so the solutes are separated. ↓ STATIONARY PHASE · MOVING PHASE · SOLVENT FRONT · PARTITION CHROMATOGRAPHY ↑ PARTITION[2]

EF005 stationary phase (*n.*) In the countercurrent distribution one solvent is stationary while the other is moved from tube to tube. In the same way in partition chromatography, one solvent, *i.e.* the solvent held on the filter paper or absorbent material or column, is stationary. It is called the stationary phase, *e.g.* water absorbed on silica gel may form the stationary phase. ↑ COUNTERCURRENT DISTRIBUTION

EF006 moving phase (*n.*) In countercurrent distribution, one solvent (the upper one) is moved from tube to tube. In the same way in partition chromatography, one solvent moves. This is the moving phase, *e.g.* if the stationary phase is water absorbed on silica gel then the moving phase will be a liquid immiscible with water. ↑ COUNTERCURRENT DISTRIBUTION

EF007 solvent front (*n.*) The boundary of the solvent at a particular line as it passes through paper or a thin absorbent layer in chromatography. ↑ COUNTERCURRENT DISTRIBUTION

EF008 chromatography (*n.*) A technique for the separation of a mixture of solutes by the differential movement of the individual solutes through a porous medium, under the influence of a moving solvent. ↓ PARTITION CHROMATOGRAPHY · CHROMATOPLATE · DEVELOPMENT[2] · ADSORPTION[2] → SORBENT

EF009 partition chromatography (*n.*) Sheets of filter paper, columns, or thin layers of absorbent material, are used to hold the solvent (the stationary phase) while the other solvent (the moving phase) flows past. The factor which influences the movement of a solute is its relative solubility. ↓ PAPER CHROMATOGRAPHY · THIN-LAYER CHROMATOGRAPHY · COLUMN CHROMATOGRAPHY · ADSORPTION CHROMATOGRAPHY · ION EXCHANGE CHROMATOGRAPHY ↑ CHROMATOGRAPHY

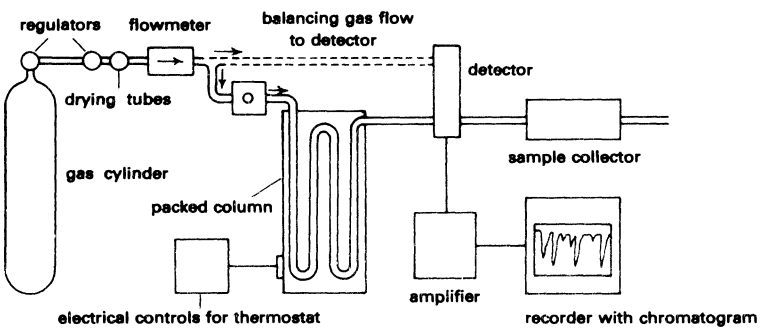
EF010 paper chromatography (*n.*) A form of chromatography in which separations are carried out on sheets or strips of prepared paper similar to filter paper using a suitable solvent as the moving phase. It is usually used for analysis of small samples of a mixture. ↑ PARTITION CHROMATOGRAPHY

EF011 thin-layer chromatography (*n.*) A form of chromatography in which separation is carried out on a thin layer of absorbent material supported on a glass plate. Materials used include alumina and silica gel. The thickness of the layer should be of the order of 0·25 mm. ↑ PARTITION CHROMATOGRAPHY

EF012 column chromatography (*n.*) A form of chromatography in which a column (usually a glass tube packed with a suitable material) is used for the separation. The mixture may separate by partition, adsorption, or ion exchange. ↑ PARTITION CHROMATOGRAPHY

EF013 adsorption chromatography (*n.*) A method of chromatography which depends upon the property of a solid to adsorb certain materials. This type of separation can be carried out on thin layers or columns depending upon the medium used, *e.g.* metallic oxides, silica gel, charcoal. ↑ PARTITION CHROMATOGRAPHY

EF014 ion-exchange chromatography (*n.*) This process can be carried out on thin layers or columns of special adsorbents which contain ionic groups which can be exchanged. Certain resins are useful for this purpose. They may be cation exchange resins or anion exchange resins. ↑ PARTITION CHROMATOGRAPHY



GAS CHROMATOGRAPHY

EF015 gas chromatography (*n.*) A type of chromatography used for the separation of gases and volatile liquids or solids in the gaseous state. The substances to be separated (or analysed) are carried by an inert gas and passed through a column of suitable material. If the substances to be analysed or separated are gases, an adsorption column is used (gas/solid chromatography), and for liquids and volatile solids a partition column is used (gas/liquid chromatography). ↑ PARTITION CHROMATOGRAPHY

EF016 chromatoplate (*n.*) The prepared thin layer of glass used in thin-layer chromatography. ↓ CHROMATOGRAM ↑ CHROMATOGRAPHY

EF017 chromatogram (*n.*) The paper after development has taken place in paper chromatography. ↑ PAPER CHROMATOGRAPHY · CHROMATOPLATE

EF018 development[2] (*n.*) The process in which a solvent flows through the paper in paper chromatography to produce separation of the mixture. ↓ ELUTION · LOCATION[2] · ACTIVATION · DEACTIVATION ↑ CHROMATOGRAPHY

EF019 elution (*n.*) The process of allowing a solvent to flow steadily through a column in column chromatography to bring about separation. —***eluant*** (*n.*) ***elute*** (*v.*) ***eluting*** (*adj.*) ↑ DEVELOPMENT[2]

EF020 location[2] (*n.*) The process of discovering the position of the separated compounds in chromatography. If they are coloured there is no difficulty. If they are colourless, various procedures are available for making them visible, *e.g.* the use of ultraviolet light. ↑ DEVELOPMENT[2]

EF021 activation (*n.*) The process of drying a chromatoplate. This removes the water and activates the plate for adsorption chromatography. If materials like silica gel or cellulose are used some water is allowed to return. —ACTIVATE, ***deactivate*** (*v.*) ↑ DEVELOPMENT[2]

EF022 deactivation (*n.*) The process of allowing an activated chromatoplate to absorb water from the atmosphere. ↑ DEVELOPMENT[2]

EF023 adsorption[2] (*n.*) A surface phenomenon in which a higher concentration of a substance forms at a surface of a solid (the stationary phase) than is present in the moving phase. The process may depend upon solute molecules being attached by, ***a*** weak van der Waals forces; ***b*** hydrogen bonding; ***c*** chemical bonds. ↑ CHROMATOGRAPHY

Conductance and Electrolysis

EG001 conductance[2] (*n.*) The reciprocal of the resistance of a conductor, either a metal or a solution.

$$\text{conductance} = \frac{1}{\text{resistance}}$$

The units of conductance are ohm^{-1} (Ω^{-1}). A conductor which has a resistance of 10 ohm has a conductance of 0·1 ohm^{-1}. ↓ CONDUCTIVITY[2] · DILUTION[2] · CONDUCTIVITY CELL · ELECTROLYSIS · ELECTROMOTIVE FORCE

EG002 conductivity[2] (*n.*) The disposition of a metal or a solution of stated concentration to conduct electricity. It is also the measure of the ability of a conductor to conduct electricity. Conductivities of solutions can be compared under comparable conditions. Conductivity is the reciprocal of resistivity.

$$\text{conductivity } (\kappa) = \frac{1}{\text{resistivity}}$$

The units of conductivity are Ω^{-1} cm^{-1}. If R is the resistance in ohms of a solution in a conductivity cell then:

$$R = \frac{l}{\kappa a} \text{ or } \kappa = \frac{l}{Ra}$$

When l is the distance between electrodes (or length of wire) and a is the surface area of the electrode (or of the wire), the value $\frac{l}{a}$ is called the cell constant when solutions are under discussion. ↓ SPECIFIC CONDUCTIVITY · MOLAR CONDUCTIVITY · EQUILAVALENT CONDUCTIVITY ↑ CONDUCTANCE[2]

EG003 specific conductivity Obselete term for CONDUCTIVITY[2].

EG004 molar conductivity (*n.*) The conductivity (κ) of a solution divided by concentration, expressed in moles per cubic decimetre (mol dm^{-3}), *e.g.* the molar conductivity of a 0·1 M solution of KCl is 0.0112 Ω^{-1} cm^{-1} divided by the concentration 0·1 mol dm^{-3}, *i.e.* 112 Ω^{-1} cm^2 mol^{-1}. ↑ CONDUCTIVITY[2]

EG005 equivalent conductivity (*n.*) The product of the conductivity and the volume (in cm^3) containing the mass of the electrolyte theoretically equivalent to one faraday of electricity, *e.g.* the conductivity of 0·01 M solution of calcium chloride is 2·04 × 10^{-3} Ω^{-1} cm^{-1}. The volume which will contain 0·5 mole of such a solution will be 50 000 cm^3 (1 mole of $CaCl_2$ is equivalent to 2 faraday). The equivalent conductivity of a 0·01 M solution of $CaCl_2$ will be 20·4 × 10^{-3} × 50 000, *i.e.* 102 Ω^{-1} cm^2. ↑ CONDUCTIVITY[2]

EG006 dilution[2] (*n.*) The dilution of a solution is the reciprocal of its concentration. If dilution is used in connection with conductivity measurements, it is usual to express dilutions in cm^{-3}. A 0·1 M solution of NaOH has a dilution of 10 000 cm^3. ↓ INFINITE DILUTION ↑ CONDUCTANCE[2]

EG007 infinite dilution (*n.*) That dilution (or concentration) at which molar conductivity is a maximum. For strong electrolytes this is the dilution (concentration) at which molar conductivity becomes independent of concentration. ↑ DILUTION[2]

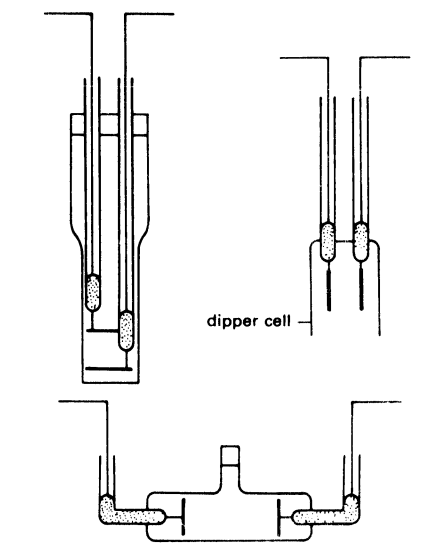
EG008 molar conductivity at infinite dilution (*n.*) The value for the molar conductivity at infinite dilution; it is given the symbol Λ_∞. ↑ DILUTION[2]

EG009 molar conductivity at zero concentration (*n.*) MOLAR CONDUCTIVITY AT INFINITE DILUTION

EG010 molar conductivity of ions (*n.*) The contribution made by an ion to the molar conductivity of an electrolyte at zero concentration (Λ_0)

$$\Lambda_0(HCl) = \Lambda_0(H^+) + \Lambda_0(Cl^-).$$

They enable Λ_0 for weak electrolytes to be determined. ↑ DILUTION[2]



CONDUCTIVITY CELLS

EG011 conductivity cell (*n.*) A small cell made of silica or insoluble glass. The electrodes are platinum which has been platinized. The dipper electrode is the most convenient type. The cell constant is obtained experimentally for each cell. The cell must be used with an a.c. supply and a suitable method for finding the null point. ↓ CELL CONSTANT · CONDUCTANCE BRIDGE

EG012 cell constant (*n.*) Each conductivity cell is given a constant either marked on by the maker or determined by the experimenter. A 0·1 M solution KCl, whose conductivity is known, is used with the cell and the value l/a determined. ↑ CONDUCTIVITY CELL

EG013 conductance bridge (*n.*) A device for direct determination of conductivity of solutions. It uses a Wheatstone bridge, an a.c. supply, and a special balance device. It is a direct reading instrument. ↑ CONDUCTIVITY CELL

EG014 electrolysis (*n.*) The process whereby an electric current is passed through a solution of an electrolyte or a molten electrolyte causing the decomposition of the electrolyte. —ELECTROLYTE (*n.*) ELECTROLYTIC (*adj.*) ELECTROLYZE (*v.*) ↓ ELECTRODE · ELECTROLYTE · DECOMPOSITION VOLTAGE · ANODIC OXIDATION · ELECTROLYZE · ANODIC ↑ CONDUCTANCE[2]

EG015 electrode (*n.*) Any piece of conducting material inserted in a gas, solution, or molten ionic solid, to enable an electric current to pass through. The term is used also in physiotherapy for the metal plates applied to the body to enable a current to be passed. A positive electrode is called an anode; a negative electrode is called a cathode. ↓ ANODE · CATHODE · VOLTAMETER PLATINIZED ELECTRODE ↑ ELECTROLYSIS → ELECTRODE POTENTIAL

EG016 anode (*n.*) A positive electrode. The electrode towards which the anions (negative ions) move during electrolysis. —ANODIC (*adj.*) ↓ CATHODE (P) ↑ ELECTRODE

EG017 cathode (*n.*) A negative electrode. The electrode towards which cations (positive ions) move in electrolysis. —CATHODIC (*adj.*) ↑ ELECTRODE · ANODE (P)

EG018 voltameter (*n.*) **1** An instrument in which the electrolytic action of a current is used for the measurement of the quantity of electricity passed through the circuit by measuring the mass of a known metal deposited on the cathode. Also called a ***coulombmeter.*** **2** A general term for any apparatus in which electrolysis is carried out. It is usually named by the cation in solution, *e.g.* Ag^+ in a silver voltameter. A special form of voltameter in which evolved gases can be measured is called the ***Hoffman voltameter.*** ↑ ELECTRODE → COULOMB

EG019 platinized electrode (*n.*) Two platinum electrodes are placed in a platinic chloride solution in HCl. The concentration of the solution is 10 g dm^{-3}. A small direct current is passed through and a layer of platinum black is deposited on the cathode. The electrode is now platinized. The purpose of platinization is to prevent polarization of the electrode. ↑ ELECTRODE

EG020 electrolyte (*n.*) A compound which when dissolved in water, or an ionizing solvent, or when molten, will conduct electricity. Electrolytes may be acids, alkalis or salts. Strong electrolytes include salts, strong acids and strong alkalis. Weak electrolytes include weak acids and weak alkalis. ↓ WEAK ELECTROLYTE · STRONG

ELECTROLYTE · NON-ELECTROLYTE ↑ ELECTROLYSIS → ACID · ALKALI · SALT

EG021 weak electrolyte (*n.*) An electrolyte which does not fully ionize in an ionizing solvent (usually water) except at infinite dilution. Solutions of weak electrolytes are poor conductors of electricity. They are weak acids and weak bases, *e.g.* ethanoic acid (CH_3COOH) is a weak electrolyte. Note: pure liquid ethanoic acid is a non-electrolyte. ↑ ELECTROLYTE

EG022 strong electrolyte (*n.*) An electrolyte which ionizes fully in solution, even at low dilution. Strong electrolytes include strong acids, strong alkalis, and salts. ↑ ELECTROLYTE

EG023 non-electrolyte (*n.*) Compounds which in solution or the liquid state do not conduct electricity, *e.g.* ***a*** sucrose ($C_{12}H_{22}O_{11}$) dissolved in water; ***b*** ethanol as a pure liquid or mixed with water. ↑ ELECTROLYTE

EG024 decomposition voltage (*n.*) The smallest voltage which will cause deposition of a given ion on a platinium electrode during electrolysis. ↓ POLARIZATION[1] ↑ ELECTROLYSIS

EG025 polarization[1] (*n.*) During the electrolysis of a solution of sulphuric acid (H_2SO_4), oxygen and hydrogen collect on the surface of the electrodes, changing the nature of the electrodes. The electrodes are said to be polarized. This arrangement forms a cell with its own e.m.f. in the opposite direction to the electrolyzing e.m.f. If a cell is set up with zinc/sulphuric acid/copper the same process takes place reducing the forward e.m.f. to zero. ↑ DECOMPOSITION VOLTAGE

EG026 anodic oxidation (*n.*) The process at an anode during electrolysis involving the anion giving electrons to the anode: $2\ Cl^- \rightarrow Cl_2 + 2e$. The Cl^- gives up an electron and so is oxidized. ↓ ANODIZING · CATHODIC REDUCTION · ELECTROPLATING ↑ ELECTROLYSIS → OXIDATION · PLATING · PLATING BATH

EG027 anodizing (*n.*) The process of forming an oxide layer by electrolysis. During the electrolysis of dilute sulphuric acid with an aluminium plate as anode, the protective film of aluminium oxide is thickened. This film of oxide can absorb dyes and so produce coloured surfaces. —ANODIZE (*v.*) ↑ ANODIC OXIDATION

EG028 cathodic reduction (*n.*) The process at a cathode during electrolysis involving the cation gaining electrons from the cathode: $Cu^{2+} + 2e \rightarrow Cu$. The Cu^{2+} gains electrons and so is reduced. ↑ ANODIC OXIDATION → REDUCTION

EG029 electroplating (*n.*) The deposition of a thin layer of metal on another metal by electrolysis. This is done by using the receiving metal as the cathode and using a solution of a suitable salt of the metal to be deposited as the electrolyte. An iron rod may be plated with nickel by using a solution containing nickel sulphate with certain additives. The iron rod is used as the cathode: $Ni^{2+} \rightarrow Ni + 2e$ ↑ ANODIC OXIDATION

EG030 electrolyze (*v.t.*) To pass a direct current through a solution of, or a molten, electrolyte and decompose it, *e.g.* sodium metal is obtained by electrolyzing molten sodium chloride which contains a flux to reduce the melting point. —ELECTROLYSIS (*n.*) ELECTROLYTIC, ***electrolysed*** (*adj.*) ***electrolytically*** (*adj.*) ↓ DISCHARGE[2] · ANODIZE ↑ ELECTROLYSIS

EG031 discharge[2] (*v.t.,i.*) To remove the charge from or lose charge; used of ions which change to atoms at electrodes during electrolysis, *e.g.* during electrolysis of molten sodium chloride, the sodium ion (Na^+) takes an electron from the cathode to become Na; it has been discharged. Similarly the chlorine ion (Cl^-) loses an electron to the anode to become a chlorine atom Cl. ↑ ELECTROLYZE

EG032 anodize (*v.t.*) To form an oxide layer by electrolysis, as in the anodizing of aluminium using sulphuric acid. —***anodization*** (*n.*) ***anodized*** (*adj.*) ↑ ELECTROLYZE

EG033 anodic (*adj.*) Relating to the anode or to what happens at the anode, *e.g.* anodic oxidation. —ANODE (*n.*) ↓ CATHODIC (P) · ELECTROLYTIC · ELECTROCHEMICAL ↑ ELECTROLYSIS

EG034 cathodic (*adj.*) Relating to the cathode or what happens at the cathode. —CATHODE (*n.*) ↑ ANODIC (P)

EG035 electrolytic (*adj.*) Of or concerning electrolysis and electrolytes, *e.g.* ***a*** aluminium is extracted by an electrolytic method; ***b*** the reaction taking place at the cathode during electrolysis is electrolytic reduction (also called **cathodic** reduction); ***c*** an acid forming ions in aqueous solution is electrolytic dissociation ↑ ANODIC

EG036 electrochemical (*adj.*) Concerning the study of the electrical properties of solutions and the ions which they contain, *e.g.* ***a*** the **electrochemical equivalent** of an ion is the mass of the ion deposited during electrolysis by one coulomb of electricity; ***b*** the **electrochemical series** is a series in which the elements are listed according to their standard electrode potentials with the most negative value at the top; hydrogen is taken as zero. ↑ ANODIC

EG037 anion (*n.*) An ion which carries negative charge. Anions move to the anode (+) during electrolysis. They may be simple ions, such as Cl^- and O^{2-}, or complex ions, such as ZnO_2^{2-} and SO_4^{2-}. —ANIONIC (*adj.*) ↓ CATION (P) · AQUAION → ION · COMPLEX ION

EG038 cation (*n.*) An ion which carries positive charge. Cations are ions which move to the cathode (−) in electrolysis. They may be simple ions, such as Na^+ and Fe^{3+}, or complex ions, such as $[Cu(NH_3)_4]^{2+}$. —CATIONIC (*adj.*) ↑ ANION (P)

EG039 aquaion (*n.*) A complex ion in which water molecules are bonded by a coordinate bond to a central atom of a

metal, *e.g.* $[Cu(H_2O)_4]^{2+}$ and $[Fe(H_2O)_6]^{3+}$. ↑ ANION

EG040 faraday (*n.*) The faraday is the name given to a quantity of electricity equal to that of one mole of electrons. It is 96 487 coulombs. In electrolysis, 1 faraday will discharge or produce 1 mole of monovalent ions. ↓ ELECTROCHEMICAL EQUIVALENT ↑ ELECTROLYSIS → ION

EG041 electrochemical equivalent (*n.*) The mass of an element or compound which may be liberated at an electrode during electrolysis by the passage of one coulomb of electricity. ↑ FARADAY

EG042 anionic (*adj.*) Relating to an anion, *e.g.* an anionic complex is the same as a complex anion. —ANION (*n.*) ↓ CATIONIC (P) → ION

EG043 cationic (*adj.*) Relating to a cation, *e.g.* a cationic complex is the same as a complex cation. —CATION (*n.*) ↑ ANIONIC (P)

EG044 electromotive force (e.m.f.) (*n.*) As it concerns the chemist, this may be defined as the driving force of a cell. Another convenient definition is that the e.m.f. of a source of electric current is the potential difference between its terminals in open circuit. The symbol is E and the unit is the volt, V. ↓ PRIMARY CELL · ELECTRODE POTENTIAL · REDOX POTENTIAL[2] · DANIELL CELL ↑ CONDUCTANCE[2]

EG045 primary cell (*n.*) A cell formed by putting two different metals into an electrolyte, or different electrolytes connected by a bridge or through a porous pot. The source of the energy is due to the electrode potentials which develop between electrode and electrolyte, *e.g.* ***a*** a simple voltaic cell, which is an electrode of copper and an electrode of zinc in a dilute solution of sulphuric acid; ***b*** a cell with electrodes in solutions of their salts connected through a porous pot or by a bridge. A primary cell is one which produces electricity, in contrast to a **secondary cell**, which stores electricity. ↓ SECONDARY CELL · ACCUMULATOR · BATTERY[2] ↑ ELECTROMOTIVE FORCE

EG046 secondary cell (*n.*) A cell in which the electrodes are modified by passing an electric current through the cell. When the current stops, the cell is capable of providing an e.m.f. A useful type is the cell using lead plates in sulphuric acid. If a current is passed through, lead (IV) oxide (PbO_2) forms on the anode. The cell will now develop an e.m.f. When discharged, lead (II) sulphate forms on both plates. On charging, the anode becomes coated with PbO_2 and the cathode with Pb. Another type of secondary cell is made with electrodes of nickel and iron, with an electrolyte of potassium hydroxide. ↑ PRIMARY CELL

EG047 accumulator (*n.*) The name commonly given to a secondary cell because it accumulates chemical energy which can be reversibly released as electrical energy. ↑ PRIMARY CELL → ACCUMULATE

EG048 battery[2] (*n.*) A set of objects, instruments or devices put together so that the total effect is greater than that of the single one. Thus it is a group of cells put together to increase the total e.m.f. A car battery consists of a number of secondary cells. ↑ PRIMARY CELL

EG049 electrode potential (*n.*) When two pieces of different metals are placed in a solution of an electrolyte, an electric current flows, *i.e.* electrons flow, if the metals are connected by a conductor. There is a definite difference of electrical potential between the two pieces of metal which acts as an electrical pressure to drive current from one metal to the other. The potentials at the pieces of metal are called the electrode potentials of the metals, and the algebraic difference between the electrode potentials gives rise to the electromotive force which drives the current round the circuit. For example, when a piece of zinc and a piece of copper are placed in a solution of an electrolyte, an electric current flows from the copper to the zinc if the two metals are connected by a conductor, *i.e.* electrons flow from the zinc to the copper. The zinc has a negative electrode potential with respect to the copper, and the difference in electrode potentials, under standard conditions, is 1·1 V, which is the e.m.f. of the device. ↓ STANDARD ELECTRODE POTENTIAL · HYDROGEN ELECTRODE · ELECTROCHEMICAL SERIES ↑ ELECTROMOTIVE FORCE

EG050 overpotential (*n.*) The potential over and above the standard (reversible) electrode potential for the expected electrode reaction to occur, *e.g.* hydrogen is evolved at a platinum cathode in electrolysis at very little above the electrode potential. At a mercury cathode an additional potential of 1 V is required for hydrogen to be evolved. ↑ ELECTRODE POTENTIAL

EG051 standard electrode potential (*n.*) The electrode potential of a metal or a gas in contact with a 1 M solution of its ions at 25°C. ↑ ELECTRODE POTENTIAL

EG052 hydrogen electrode (*n.*) A device for using hydrogen gas as an electrode by adsorbing it on the platinum blackened surface of a platinum electrode. If the electrode is in contact with a 1 M solution of hydrogen ions at 25°C, the device is a standard hydrogen electrode. By convention, the electrode potential of a standard hydrogen electrode is zero. ↑ ELECTRODE POTENTIAL

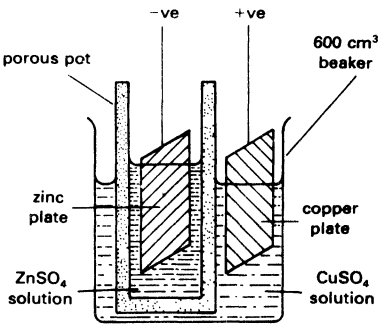
EG053 electrochemical series (*n.*) This series contains the elements listed in order of their electrode potentials, starting with the most negative. ↑ ELECTRODE POTENTIAL → ACTIVITY SERIES

EG054 redox potential[2] (*n.*) Standard electrode potentials of metals show the comparative strength of metals as reducing agents, *e.g.* copper with a value of +0·34 V is a weaker reducing agent than hydrogen (0·0 V) whereas sodium −2·71 V is a stronger reducing agent than hydrogen, *i.e.* it goes more readily from Na to Na^+. Into the series may be introduced other ion changes, *e.g.*

$MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 1{\cdot}52$ V. This is a redox reaction and therefore the value +1·52 V is the redox potential for $MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O$. Such values explain why potassium manganate (VII) ($KMnO_4$) will oxidize hydrochloric acid while potassium dichromate (VI) will not:

$\frac{1}{2}Cl_2 + 1e \rightarrow Cl^- \quad + 1{\cdot}36$ V

$Cr_2O_7^{2-} + 14H^+ + 6e \rightarrow 2Cr^{3+} + 7H_2O \quad + 1{\cdot}33$ V.



DANIELL CELL

↓ REDOX SERIES[2] ↑ ELECTROMOTIVE FORCE

EG055 redox series[2] (*n.*) The listing of standard electrode potentials as redox potentials for redox reactions. See table of REDOX POTENTIALS (Appendix 10). These show the relative power of ions as oxidizing agents. ↑ REDOX POTENTIAL[2]

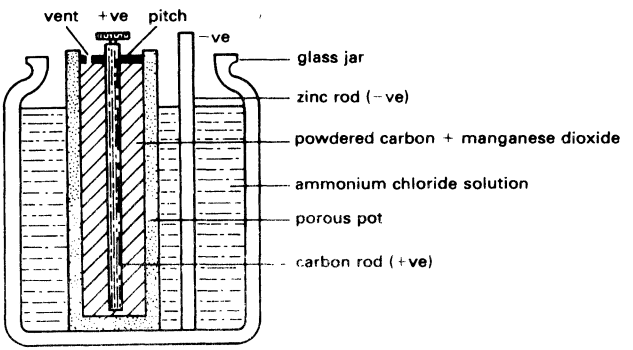
EG056 Daniell cell (*n.*) A cell in which the positive plate is a copper plate and the negative is a zinc plate. The zinc plate is immersed in a zinc sulphate solution contained in a porous pot. The porous pot stands in a solution of copper sulphate. The cell is $Cu/CuSO_4/ZnSO_4/Zn$. The energy arises from the reactions:

$Cu^{2+} + 2e \rightarrow Cu$

$Zn - 2e \rightarrow Zn^{2+}$

↓ LECLANCHÉ CELL ↑ ELECTROMOTIVE FORCE

EG057 Leclanché cell (*n.*) This cell has a positive carbon pole and a negative zinc pole. The zinc is in a solution of ammonium chloride. The carbon rod is packed in a porous pot with carbon and manganese dioxide. The manganese dioxide is the depolarizer. The cell may be set up using an outer zinc case containing a paste of ammonium chloride. The porous pot is placed in this. This is the so-called dry cell. These cells are only suitable for intermittent use. ↑ DANIELL CELL



LECLANCHÉ CELL

Growth

FA001 growth (*n.*) An increase in size of an organism, or of any part of an organism; it is a natural process effected by division of cells, and a fundamental characteristic of living things. The differentiation of cells is usually included with growth, as it usually occurs at the same time as growth, or follows a change in size, although differentiation itself makes no contribution to plant size. Cells contribute to size increase by, *a* increasing in volume; *b* multiplication of number as a result of cell division □ *growth is retarded by adverse conditions* (*i.e.* it is made slower); *growth is stimulated by favourable conditions* (*i.e.* it is started); *growth is accelerated by certain factors* (*i.e.* it is made quicker); *growth is promoted by certain hormones* (*i.e.* conditions are made favourable); *growth is arrested under certain conditions* (*i.e.* it is stopped). —GROW (*v.*) ↓ DEVELOPMENT[1] · DORMANCY · ATROPHY · MATURITY · GERONTOLOGY · SPROUT[2] · BASIPETAL · VITAL[2] · DORMANT[1] · ADULT · GERMINATION → CELL

FA002 development[1] (*n.*) The change in structures which takes place in an organism between its beginning and its maturity as a result of cell differentiation. This is not the same as growth, which is limited to an increase in size; development results in an increasing ability to function, *e.g.* the development of wings from wing buds on a bird; these limbs increase in size (*i.e.* they grow) but in addition new structures are formed which finally enable the wing to function in flight. ↓ GRAND PERIOD OF GROWTH · SURVIVAL[2] · VITALITY · REGENERATION[1] · COMPLETE REGENERATION · BODY REGENERATION · ORGAN REGENERATION · TISSUE REGENERATION · PLANT REGENERATION · HYBRID VIGOUR · HETEROSIS · PHEROMONE · STROBILATION ↑ GROWTH → DEVELOP[1]

FA003 grand period of growth (*n.*) (In plants) the total period of increasing size of a cell, organ, or part of an organ. During the grand period, increase in size is slow at first, reaches a maximum rate of increase, and then finally slows down until growth ceases at maturity. ↑ DEVELOPMENT[1]

FA004 survival[2] (*n.*) The process of continuing to live in unfavourable or adverse conditions, or in the presence of predators, *e.g.* the survival of an animal in many cases depends upon its ability to run faster than its predators. —SURVIVOR (*n.*) SURVIVE (*v.*) ↑ DEVELOPMENT[1]

FA005 vitality (*n.*) The characteristic of organisms which describes their ability to combat adverse or unfavourable conditions and to stay alive □ *a person's vitality is undermined by a chronic disease* ↑ DEVELOPMENT[1]

FA006 regeneration[1] (*n.*) The ability of an organism to replace tissues, organs, or parts of the body, that have been lost through injury. In animals, the ability displayed is very variable, being greatest in the lower animals and least in the higher animals. In plants, regeneration is of common occurrence. —REGENERATE (*v.*) ↑ DEVELOPMENT[1] → AUTOTOMY

FA007 complete regeneration (*n.*) (In hydroids, medusoids, and some platyhelminthes) the ability to regenerate a complete organism from a small portion; the portion must contain ectoderm, mesoderm, and endoderm, and the tissues must contain sufficient food reserve. In planarians, the cells in the portion first become alike, then a head (if absent) is the first structure regenerated, and the remainder of the body develops afterwards. ↑ REGENERATION[1]

FA008 body regeneration (*n.*) In earthworms, if the worm is cut in two, each portion regenerates a new body. ↑ REGENERATION[1]

FA009 organ regeneration (*n.*) (In crustaceans, amphibians, lizards and other animals) the regeneration of an appendage, such as the claws of a lobster or the tail of a lizard. ↑ REGENERATION[1]

FA010 tissue regeneration (*n.*) In birds and mammals, only tissues, such as flesh and bone, can be regenerated. ↑ REGENERATION[1]

FA011 plant regeneration (*n.*) Regeneration in plants is the growth of dormant buds, adventitious buds, and adventitious roots. This property of plants is a basis of plant propagation, *e.g.* the growth of plants from cuttings. ↑ REGENERATION[1] → ADVENTITIOUS

FA012 hybrid vigour (*n.*) Increased vigour of growth, fertility and sturdiness, often seen as a result of crossing two genetically different lines; it is the result of new genetic combinations associated with increased heterozygosity. ↑ DEVELOPMENT[1] → HETEROZYGOSIS

FA013 heterosis (*n.*) Alternative term for HYBRID VIGOUR.

FA014 pheromone (*n.*) A chemical substance, released by an animal, which influences the development, or behaviour, of other animals of the same species, *e.g.* ***a*** sexual attractants, particularly in some species of insect; ***b*** the substance released by queen bees which prevents the development of other queens. ↑ DEVELOPMENT[1]

FA015 strobilation (*n.*) The process of increasing body length by budding off new segments, *e.g.* in tapeworms, the budding of new proglottides from a scolex is strobilation. ↑ DEVELOPMENT[1] → SCOLEX

FA016 dormancy (*n.*) A state of suspended growth in an organism, with almost inactive metabolism. The whole organism may be in a state of dormancy, or a reproductive body only may be dormant, *e.g.* ***a*** the spores and seeds of plants; ***b*** the resting eggs of animals. In seed plants, dormancy may be caused by unfavourable conditions of temperature, moisture, or an unfavourable photoperiod; mechanical dormancy of seeds is caused by a hard and impermeable testa; chemical dormancy of seeds is caused by chemical inhibitors in fruit juice. Many plants have a dormant period in their annual rhythm or life cycle often of value for survival. In animals, dormancy is usually controlled by external conditions. —DORMANT (*adj.*) ↓ HIBERNATION (H) · AESTIVATION[1] (H) · DIAPAUSE (H) · AFTER-RIPENING (H) · QUIESCENCE · TORPOR ↑ GROWTH

FA017 hibernation (*n.*) (Of animals) dormancy during winter. It is a state of complete inactivity, or of deep sleep. Amphibians and reptiles bury themselves in protection against the cold; their temperature is that of the surroundings. In a few groups of mammals, true hibernation occurs, and the body temperature drops almost to that of the surroundings; in other groups of mammals, the body temperature drops a few degrees below normal, the animal sleeps for varying periods of time, but awakens periodically. Birds and aquatic animals do not hibernate. Before hibernation, most animals deposit fat under their skin; this acts as a food reserve during hibernation; other animals, which waken periodically, store food as a reserve, *e.g.*

squirrels store nuts. —***hibernate*** (*v.*) ↓ AESTIVATION[1] (An) ↑ DORMANCY

FA018 aestivation[1] (*n.*) (Of animals) dormancy during summer or drought. The animal hides to prevent dehydration and becomes torpid. ↑ DORMANCY · HIBERNATION (An)

FA019 diapause (*n.*) (In some insects) a period of suspended growth and greatly decreased metabolism controlled by external conditions. Diapause may be either spontaneous in order to avoid some sudden change in conditions or occur seasonally to avoid regular adverse conditions. Unlike hibernation and aestivation, diapause can occur at any time of the year. ↑ DORMANCY

FA020 after-ripening (*n.*) A type of dormancy exhibited by some seeds. The seeds will not germinate even though the embryo is fully developed and external conditions are suitable; a period of time, during which the seed is dormant, must elapse. The phenomenon is thought to be associated with a delay in producing growth hormones, or with the gradual breakdown of growth inhibitors. ↑ DORMANCY

FA021 quiescence (*n.*) A temporary state in which development, or any other activity, ceases; it is caused by unfavourable conditions. The focus is on the temporary nature as opposed to the more permanent or functional state of dormancy, *e.g.* a seed may not be dormant, but only quiescent, if all conditions for germination are favourable except for a lack of oxygen (a temporary situation) □ *quiescence is broken when the seed germinates* —***quiescent*** (*adj.*) ↑ DORMANCY

FA022 torpor (*n.*) The condition of being torpid. ↓ TORPID ↑ DORMANCY

FA023 atrophy (*n.*) The diminution in size and in function of an organ, or in the amount of a tissue, especially caused by lack of use, although it may arise from a pathological condition. Atrophy of the cortex of the adrenal gland causes Addison's disease (the cortex ceases to function and diminishes in size). —***atrophical*** (*adj.*) ATROPHY (*v.*) ↓ HYPERTROPHY (An) · HYPERPLASIA (An) · COMPENSATORY HYPERTROPHY ↑ GROWTH

FA024 hypertrophy (*n.*) Excessive growth of tissue or of an organ caused by an increase in size of individual cells, or of collagen fibres, without an increase in their number, *e.g.* ***a*** (in muscles) growth caused by frequent exercise; ***b*** (in plants) excessive growth caused by the presence of certain parasites. —HYPERTROPHIC, HYPERTROPHIED (*adj.*) ***hypertrophy*** (*v.*) ↑ ATROPHY

FA025 hyperplasia (*n.*) Excessive growth of tissue or organ caused by an increase in the number of cells, each cell remaining the same size, *e.g.* when part of a mammalian liver is removed, the remaining portion undergoes hyperplasia and the missing portion is regenerated. —***hyperplastic*** (*adj.*) ↑ ATROPHY

FA026 compensatory hypertrophy (*n*) An increase in size of a tissue or of an organ in response to the removal of part of the tissue or organ. The increase may arise from hypertrophy or hyperplasia, *e.g.* when one mammalian kidney is removed, the other increases in size by compensatory hypertrophy. ↑ ATROPHY

FA027 maturity (*n.*) The stage in the life of an organism when it is mature. —MATURATION (*n.*) MATURE (*v.*) ↓ MATURATION · SENILITY · MORTALITY · MATURE[1] ↑ GROWTH

FA028 maturation (*n.*) The process of development to maturity, especially of germ-cells; the term implies a natural process similar to the ripening of fruit. ↓ MATURE[1] ↑ MATURITY

FA029 senility (*n.*) The condition of being senile. To contrast **senility** with **senescence**: during senescence (a period in the animal's life), an animal loses some control over coordination; loss of control over coordination is a characteristic of senility (the condition of being senile) in human beings. ↓ SENILE · SENESCENCE ↑ MATURITY

FA030 mortality (*n.*) **1** The condition of being subject to death. **2** The death rate in different age groups in a population, *e.g.* high mortality amongst children under five. ↓ MORTAL ↑ MATURITY

FA031 gerontology (*n.*) The study of changes in organisms taking place in old age, *i.e.* the study of senescence and senility. ↓ GERIATRICS ↑ GROWTH

FA032 geriatrics (*n.*) The medical care of old people. —***geriatric*** (*adj.*) ↑ GERONTOLOGY

FA033 sprout[2] (*v.i.*) To give rise to, or to put forth, shoots, hairs, buds (or any similar new structure) by growth □ *hair sprouts irregularly on the ventral side of a mammal* —SPROUT (*n.*) ↓ WITHER · MATURE[1] ↑ GROWTH

FA034 wither (*v.i.*) To lose vigour, by becoming dry and shrivelled through lack of water or nutrients. ↑ SPROUT[2]

FA035 mature[1] (*v.t.,i.*) **1** (*v.i.*) (Of organisms) to develop until maturity is reached. **2** (*v.t.*) To apply a process to any form of tissue in order to make it of use, *e.g.* ***a*** to mature tobacco leaves; ***b*** to mature fermented beverages. The terms **cure** and **ripen** are used for similar processes, cure implying some form of preservation, and ripen implying the allowing of a natural process to take place, *e.g.* to cure leather and to ripen cheese. ↑ MATURITY · SPROUT[2]

FA036 twine[2] (*v.i.*) (Of plants) to grow round a support, so that the stem is in the shape of a helix, or corkscrew. —***twining*** (*adj.*) ↑ GROWTH

FA037 basipetal (*adj.*) Describes the successive development of plant organs, such as leaves or inflorescences, from the apex to the base; the oldest are at the apex. ↓ ACROPETAL (An) · STUNTED ↑ GROWTH

FA038 acropetal (*adj*) Describes the successive development of plant organs, such as flowers, leaves, and roots, from the base to the apex; the youngest are at the apex. ↑ BASIPETAL (An) · GROWTH

FA039 stunted (*adj.*) **1** Describes an organism in which growth has been stopped, or slowed down. **2** Describes an organism which has not developed to its full size, *i.e.* it is under-developed in size but not in function. ↑ BASIPETAL → ETIOLATED (An)

FA040 vital[2] (*adj.*) Of or to do with life or living, *e.g.* the vital functions of an organism are those on which life depends. —VITALITY (*n.*) ↓ MORTAL · SENILE · GERONTIC · GERIATRIC · MATURE[2] ↑ GROWTH

FA041 mortal (*adj.*) **1** Of or to do with death or dying; the term describes an affliction of an organism, *e.g.* death results from a mortal injury (the injury has been inflicted). Contrast **lethal**, which describes an agent causing, or able to cause, death; a lethal disease kills a person, but a person dies from a mortal injury (the injury does not kill him at once). **2** Describes an organism which will eventually die, *e.g.* all vertebrates are mortal (they will all die eventually) □ *an animal is mortal* —MORTALITY (*n.*) ↑ MORTALITY · VITAL[2]

FA042 senile (*adj.*) Describes an animal whose vital functions are diminished owing to age. The term is usually restricted to the higher animals, because their functions are more complex in nature. —SENILITY (*n.*) ↑ VITAL[2]

FA043 gerontic (*adj.*) (In organisms) of or to do with old age, *e.g.* senility is a gerontic condition. —GERONTOLOGY (*n.*) ↑ VITAL[2]

FA044 geriatric (*adj.*) Of or to do with, geriatrics, *e.g.* a geriatric hospital where old people are under medical care. ↑ VITAL[2]

FA045 mature[2] (*adj.*) **1** (Of all organisms) fully grown and fully developed sexually. **2** (Of any structure) fully developed and fully functional. Compare **adult**, which is used to describe many, but not all, forms of mature animals. —MATURITY (*n.*) MATURATION (*n.*) MATURE (*v.*) ↑ VITAL[2]

FA046 dormant[1] (*adj.*) **1** Describes an organism which is resting and not growing over a period of time, *e.g.* ***a*** a deciduous tree is dormant in winter; ***b*** a hibernating animal is dormant during winter. **2** Describes a disease which infects a person, without the person showing any signs or symptoms, *e.g.* the disease in a carrier is dormant. **3** Describes any inactive object which may become active again, *e.g.* a volcano is dormant if there is a possibility it will become active again. Contrast **extinct**: if a volcano is extinct, it will never become active again. ↓ TORPID · LETHARGIC · HYPERTROPHIC · HYPERTROPHIED ↑ GROWTH → EXTINCT · ACTIVE (An)

FA047 torpid (*adj.*) Describes an animal with little or no response to external stimuli, *e.g.* ***a*** a reptile is torpid in cold weather; ***b*** a snake is torpid when casting its skin; ***c*** a hibernating animal is torpid. —***torpor*** (*n.*) ↑ DORMANT[1]

FA048 lethargic (*adj.*) Describes an animal with a very slow response to an external stimulus; the state arises from pathological conditions. Contrast **lazy** which describes an animal suppressing its response to stimuli by its own will. —***lethargy*** (*n.*) ↑ DORMANT[1]

FA049 hypertrophic (*adj.*) Describes a process associated with hypertrophy, *e.g.* the result of exercising a muscle is hypertrophic growth. Contrast **hypertrophied**: the exercised muscle when it increases in size is hypertrophied. ↑ DORMANT[1]

FA050 hypertrophied (*adj.*) Describes a tissue or an organ which has undergone hypertrophy. ↑ DORMANT[1]

FA051 adult (*adj.*) (Of animals) fully grown and fully developed sexually. —ADULT (*n.*) ↓ INFANCY · SENESCENCE ↑ GROWTH

FA052 infancy (*n.*) (In human beings) the period of the first few years of life; the individual then develops into a child. —***infant*** (*n.*) ***infantile*** (*adj.*) ↓ CHILDHOOD · PUBERTY · ADOLESCENCE · ADULTHOOD · SENESCENCE ↑ ADULT

FA053 childhood (*n.*) The period during which a person is a child, *i.e.* older than an infant, but yet having reached the age of puberty. It is a period of body growth and development. ↑ INFANCY

FA054 puberty (*n.*) The stage of life at which an animal, of either sex, becomes sexually mature, *i.e.* capable of reproducing offspring. ↑ INFANCY

FA055 adolescence (*n.*) (In human beings) the period of life from the start of puberty to the full sexual development of an individual. —***adolescent*** (*n.*) ***adolescent*** (*adj.*) ↑ INFANCY

FA056 adulthood (*n.*) The period of life during which an animal is an adult. ↑ INFANCY

FA057 senescence (*n.*) The final stage in the life of an organism when it has nearly completed its life span. The organs and other structures lose the ability to function properly. In some protozoa, senescence describes the stage reached after many cell divisions, when the ability of the daughter cells to grow is reduced, and the cells remain small. Senescence follows maturity or adulthood. —SENESCENT (*adj.*) ↑ INFANCY · SENILITY

FA058 senescent (*adj.*) Describes an organism, or part of an organism, near the end of its existence, *e.g.* a senescent leaf is one which is changing colour, no longer photosynthesizes, and is ready to fall, as from a deciduous tree in autumn. ↑ ADULT → ABSCISSION

FA059 germination (*n.*) A process in which the embryo of a viable seed or the viable spore of a plant, under favourable conditions (*i.e.* sufficient water and oxygen, a suitable temperature, and suitable light) starts to grow. The process involves the conversion of stored food into chemical substances of the living cell, and is under the influence of growth promoters and growth inhibitors □ *a seedling germinates from a seed* —***germinated*** (*adj.*) ***germinate*** (*v.*) ↓ SEEDLING · AUXANOMETER · EPIGEAL[1] ↑ GROWTH

FA060 seedling (*n.*) A young plant newly

formed from a germinated seed. ↑ GERMINATION

FA061 auxanometer (*n.*) An instrument for measuring the rate of growth of a plant, or of parts of a plant, particularly in seedlings. ↑ GERMINATION

FA062 epigeal[1] (*adj.*) (Of cotyledons) appearing above ground, borne on the stem of a seedling; the cotyledons form the first leaves. The cotyledons are borne at the junction of the stem and the hypocotyl of the seedling. ↓ HYPOGEAL (An) ↑ GERMINATION → EPIGEAL[2] · EPIGENOUS

FA063 hypogeal (*adj.*) (Of cotyledons) remaining underground when a seed germinates to form a seedling. ↑ EPIGEAL[1] (An) → HYPOGEOUS

FA064 viviparous[2] (*adj.*) Describes plants which have seeds germinating in the fruit, *e.g.* mangrove. ↑ GERMINATION

Movement

FB001 movement (*n.*) (Of an individual animal or plant) the changing of the position or posture of the body, or of the positions of different parts of the body, *e.g.* ***a*** the movement of an arm when a hand is raised; ***b*** the movement of the wing of a bird which is flying; ***c*** the movement of the body of a man when standing up from a sitting position; ***d*** the movements of a plant through growth, as in tropisms. An organism uses up energy during movement; it is a characteristic of living things. —MOVE (*v.*) ↓ MOBILITY · ANCHORAGE · FLEX[1] · LIE · MOBILE[3] · SEDENTARY · PROTRACTILE · MOTOR[2] · BICEPS → LOCOMOTION · SENSITIVITY[1] · GROWTH · POSTURE · ORIENTATION · REST (An)

FB002 mobility (*n.*) **1** The disposition to be movable. **2** The condition of moving easily and quickly, *e.g.* many mammals exhibit greater mobility than reptiles. ↓ MOTILITY · IMMOBILITY ↑ MOVEMENT

FB003 motility (*n.*) The disposition of being motile. Contrast **motility** with **mobility**: mobility is the ability to move from place to place with a purpose, *i.e.* to carry out locomotion; motility is not associated with purpose in moving about. ↑ MOBILITY

FB004 immobility (*n.*) The condition of being immobile. ↑ MOBILITY

FB005 posture (*n.*) The way in which the body is held in a position by muscles. ↑ MOBILITY

FB006 activity[1] (*n.*) (Of animals) the process of movement or locomotion, *e.g.* diurnal animals exhibit activity only by day. It is a general term which does not specify what actions the animal is carrying out. —ACTIVE (*adj.*) ↑ MOBILITY → LOCOMOTION

FB007 anchorage (*n.*) The state of being attached to a particular place, *e.g.* a hydroid can obtain a firm anchorage to the surface of a stone but not to a surface of mud □ *the organism has its anchorage to a rock* —ANCHORED (*adj.*) ↓ ORIENTATION ANCHORED

FB008 orientation (*n.*) **1** The relative position of an organism or organ in relation to its surroundings. **2** The alteration in position of an organ or organism in response to a stimulus, *e.g.* the orientation of a fish is the alteration in direction it makes to face the flow of current in water. ↑ ANCHORAGE

FB009 flex[1] (*v.t.,i.*) **1** To move the bones of a joint closer together; to bend or (G.S.) to straighten a joint. —***flexion*** (*n.*) ↓ EXTEND[2] (Cn) · PROTRUDE[2] · RETRACT · FLICK · LASH ↑ MOVEMENT

FB010 extend[2] (*v.t.,i.*) **1** (*v.t.*) To move the bones of a joint far apart; to put them in one line. **2** (*v.i.*) To move apart; (G.S.) to straighten. —***extension*** (*n.*) ↑ FLEX[1] (Cn)

FB011 protrude[2] (*v.t.,i.*) **1** (*v.t.*) To put out a structure or organ from within a body of an animal, by muscular effort, especially through an opening, *e.g.* to protrude the tongue through the mouth. **2** (*v.i.*) To project in this way, *e.g.* the tongue can protrude from the mouth. —***protrusion*** (*n.*) ***protrusible*** (*adj.*) ↓ RETRACT (Cn) ↑ FLEX[1] → PROTUBERANCE

FB012 retract (*v.t.,i.*) To draw a structure or organ into the body of an animal by muscular effort especially into a cavity, *e.g.* a cat retracts its claws. —RETRACTION (*n.*) RETRACTILE (*adj.*) ↑ FLEX[1] · PROTRUDE[2] (Cn)

FB013 flick (*v.t.,i.*) **1** To protrude and then retract very rapidly a structure or organ from within a body of an animal, *e.g.* a frog flicks out its tongue to catch an insect; the tongue is protruded, catches the insect, and is retracted in a fraction of a second. **2** To move a whip with a light quick jerk so that the end of the whip flies out and returns with a snap. —FLICK (*n.*) ***flicking*** (*n.*) ↓ LASH (Sn) ↑ FLEX[1]

FB014 lash (*v.t.,i.*) **1** To flick out an object or appendage of an organism, with some force. The action is the same as that of flicking, but there is much more force behind the action, *e.g.* a tiger lashes out with its paw to hit an enemy □ *the cat lashed out at the rat with its paw; the cat lashes its tail* **2** To flick a whip with some force. —***lashing*** (*n.*) ↑ FLEX[1] · FLICK (Sn)

FB015 lie (*v.i.*) **(lying, lay, lain)** (Of an animal) to rest with its body in a horizontal position, on either of its sides, or on its back or front. ↓ CROUCH · SQUAT[2] · IMMOBILIZE ↑ MOVEMENT

FB016 crouch (*v.i.*) **1** (Of quadrupeds) to flex all four limbs so that the ventral surface almost touches the ground. **2** (Of bipeds) to flex the hind limbs fully while putting the

hands on the ground with the fore-limbs nearly straight. ↑ LIE

FB017 squat[2] (*v.i.*) (Of bipeds) to flex the hind-limbs fully, supporting the body by placing the buttocks on the heels. ↑ LIE

FB018 immobilize (*v.t.*) To make an object, organism, or structure, immobile. ↑ LIE

FB019 mobile[3] (*adj.*) **1** (Of objects) easily moved from place to place. **2** (Of organisms) possessing the power of locomotion and hence able to move easily from place to place. **3** (Of structures) able to be changed in configuration quickly and easily, *e.g.* the tentacles of an octopus, or of a hydra, are highly mobile. Mobile describes the disposition of the object, organism, or structure. —MOBILITY (*n.*) ↓ MOTILE · IMMOBILE (An) · NON-MOTILE · SEDENTARY (I) · SESSILE[1] (I) ↑ MOVEMENT

FB020 motile (*adj.*) Describes an organism that moves freely by its own energy, *e.g.* ***a*** cholera bacilli are motile in water; they swim about actively; ***b*** spermatozoa are motile in semen. The term is usually applied to micro-organisms which have a means of locomotion and move about in an aimless way □ *a highly motile bacterium* —MOTILITY (*n.*) ↓ SEDENTARY (Ag) · SESSILE[1] (Ag) ↑ MOBILE[3] → COLONIAL (Ag)

FB021 immobile (*adj.*) **1** Describes an object, organism, or structure, that has lost the condition of mobility, either temporarily or permanently. **2** (Of an organism) with no movement of any kind taking place, *e.g.* a cat, when waiting to spring on a bird, remains immobile. ↑ MOBILE[3]

FB022 non-motile (*adj.*) Describes a micro-organism which is not motile, especially when similar organisms are motile. ↑ MOBILE[3]

FB023 sedentary (*adj.*) (Of animals) attached by a base to the ground or to a support; not moving from one place to another. ↓ SESSILE[1] (Sn) · ANCHORED · INACTIVE · RECUMBENT ↑ MOVEMENT → FREE-LIVING (An) · MIGRATORY (An)

FB024 sessile[1] (*adj.*) **1** (Of animals) stationary in one place, or attached to the ground or to a solid object; having no power of locomotion. **2** (Of crustaceans) having eyes without stalks. ↑ MOTILE (An) · SEDENTARY (Sn)

FB025 anchored (*adj.*) (Of organisms) firmly fixed to a substrate or support by special structures such as suckers or holdfasts. The focus is on the firmness of attachment. Contrast **sessile**, where the focus is on the organism remaining in and attached to one place; or **sedentary**, where the focus is on lack of motion. ↑ SEDENTARY → HOLDFAST

FB026 inactive (*adj.*) Not active; a general term which does not specify why there is no activity, *e.g.* nocturnal animals are inactive by day (they may be resting or sleeping, or even torpid). —INACTIVITY (*n.*) ↑ SEDENTARY → DORMANT · TORPID · ACTIVE (Ag)

FB027 recumbent (*adj.*) Describes a mammal lying down. ↑ SEDENTARY

FB028 protractile (*adj.*) Describes a structure or organ that can be pushed out, *i.e.* protruded, by muscular effort from an animal's body. The normal position of the structure or organ is considered to be inside the body, and the structure is usually protruded through a hole, *e.g.* the pharynx of a Planarian, or of a Turbellarian, is protractile, as the animal can protrude its pharynx through its mouth. ↓ RETRACTILE (Cn) ↑ MOVEMENT

FB029 retractile (*adj.*) Describes a structure or organ that can be withdrawn, *i.e.* retracted, by muscular effort into an animal's body. The normal position of the structure or organ is outside the body, *e.g.* the claws of a cat are retractile; they are normally outside the paws. ↓ RETRACTOR ↑ PROTRACTILE (Cn)

FB030 motor[2] (*n.*) (Used before other nouns) concerned with the stimulation of muscles to produce movement of the body, *e.g.* a motor nerve conducts impulses which stimulate muscles to contract and produce movement. ↓ ATTACHMENT[2] · PRIME MOVER · ACTION[2] · FLEXOR · CONSTRICTOR · MONOGASTRIC · EXTRINSIC ↑ MOVEMENT → MOTOR NERVE · MOTOR NEURON

FB031 attachment[2] (*n.*) The structure by which a striped muscle is joined to a bone; there are two types of attachment, fibrous and fleshy. ↓ FIBROUS ATTACHMENT · FLESHY ATTACHMENT · ORIGIN[2] · INSERTION[2] · HEAD · TAIL · VENTER[2] · BELLY · APONEUROSIS · SLIP ↑ MOTOR[2]

FB032 fibrous attachment (*n.*) Fibrous connective tissue joins the muscle to the bone; the attachment is visible to the naked eye. ↑ ATTACHMENT[2]

FB033 fleshy attachment (*n.*) The connective tissue joining muscle to bone or to any other tissue; it is not visible to the naked eye. ↑ ATTACHMENT[2]

FB034 origin[2] (*n.*) The point of attachment of a muscle to a bone which is not moved by action of the muscle, *e.g.* the biceps muscle has its origins on the scapula and on the shoulder joint; when the biceps contracts, the forearm is moved, but the scapula is not; the origin remains fixed relative to the body. ↑ ATTACHMENT[2]

FB035 insertion[2] (*n.*) The point of attachment of a muscle to a bone or to other tissues, which is moved by action of the muscle, *e.g.* the biceps muscle has its insertion in the forearm; when the muscle contracts, the forearm is moved relative to the upper arm. An insertion is usually at the distal end of a muscle. ↑ ATTACHMENT[2]

FB036 head (*n.*) **1** The end of a muscle which is attached to the origin. **2** A separate slip of muscle which is attached to its own origin. ↑ ATTACHMENT[2]

FB037 tail (*n.*) The end of a muscle which is attached to the insertion. ↑ ATTACHMENT[2]

FB038 venter[2] (*n.*) The protuberance at the thickest part of a muscle which thickens when the muscle contracts. ↑ ATTACHMENT[2]

FB039 belly (*n.*) Alternative term for VENTER[2]. ↑ ATTACHMENT[2]

FB040 aponeurosis (*n.,pl.* **aponeuroses**) **1** A flattened tendon for the insertion of some muscles. **2** A membrane investing the end of some muscles. **3** A sheet of fibrous connective tissue providing a wide area of attachment. ↑ ATTACHMENT[2] → TENDON

FB041 slip (*n.*) A muscle segment branching off from the main muscle to a point of separate attachment. ↑ ATTACHMENT[2]

FB042 prime mover (*n.*) The muscle directly responsible for producing articulation at a joint or a change in position of a part, *e.g.* the biceps flexes the elbow, the main articulation at the joint; it is the prime mover. ↓ ANTAGONIST · SYNERGIST · FIXATION MUSCLE · AGONIST ↑ MOTOR[2] → ARTICULATION

FB043 antagonist (*n.*) A muscle acting in opposition to the action of a prime mover (the agonist), *e.g.* ***a*** the triceps is the antagonist of the biceps; ***b*** the triceps is antagonistic to the biceps. —ANTAGONISTIC (*adj.*) ↑ PRIME MOVER

FB044 synergist (*n.*) A muscle which helps a prime mover or a fixation muscle, *i.e.* it has the same action. —SYNERGIC (*adj.*) ↓ FIXATION MUSCLE ↑ PRIME MOVER

FB045 fixation muscle (*n.*) A muscle whose action prevents the disturbance of body equilibrium, particularly during movements of the limbs. ↑ PRIME MOVER → EQUILIBRIUM[2]

FB046 agonist (*n.*) Alternative term for PRIME MOVER.

FB047 action[2] (*n.*) The movement produced by a muscle. ↓ ROTATION · CIRCUMDUCTION ↑ MOTOR[2] → PRONATION · SUPINATION

FB048 rotation (*n.*) The turning of a bone or other structure about its longitudinal axis. ↑ ACTION[2]

FB049 circumduction (*n.*) The kind of motion in which the distal end of a bone describes a circle while the proximal end remains in the same place; it is produced by more than one muscle. ↑ ACTION[2]

FB050 flexor (*n.*)A muscle that bends (flexes) a limb, *e.g.* the biceps muscle (a flexor muscle) pulls the forearm towards the upper arm; it bends or flexes the arm. The movement is brought about by contraction of the muscle. ↓ EXTENSOR (Cn) · ABDUCTOR · ADDUCTOR · ELEVATOR[1] · DEPRESSOR · PROTRACTOR · RETRACTOR ↑ MOTOR[2] · FLEX[1]

FB051 extensor (*n.*) A muscle that extends a limb, *e.g.* the triceps muscle (an extensor muscle) extends the forearm; (it straightens the arm). The movement is brought about by contraction of the muscle. ↑ FLEXOR (Cn)

FB052 abductor (*n.*) A muscle that draws a limb away from the median axis of the body. —***abduction*** (*n.*) ABDUCENT (*adj.*) ↑ FLEXOR

FB053 adductor (*n.*) **1** A muscle that draws a limb towards the median axis of the body. **2** (In bivalves) the muscle that closes the two valves of the shell. —***adduction*** (*n.*) ↑ FLEXOR

FB054 elevator[1] (*n.*) A muscle that raises a limb or other structure. —***elevation*** (*n.*) ELEVATED (*adj.*) ↑ FLEXOR

FB055 depressor (*n.*) A muscle that lowers an elevated limb or elevated structure. —***depression*** (*n.*) ***depressed*** (*adj.*) ↑ FLEXOR

FB056 protractor (*n.*) A muscle that pushes or pulls out a part of an animal, *e.g.* the protractor muscle that protrudes the tongue. ↓ RETRACTOR (Cn) ↑ FLEXOR · PROTRUDE[2]

FB057 retractor (*n.*) A muscle that pulls in a part of an animal, *e.g.* the retractor muscle that retracts a cat's claws. ↑ RETRACT · FLEXOR · PROTRACTOR (Cn)

FB058 constrictor (*n.*) A muscle that constricts a structure, such as an orifice or a vessel. ↓ DILATOR (Cn) ↑ MOTOR[2] → SPHINCTER

FB059 dilator (*n.*) A muscle that expands an organ or dilates a tubular structure, *e.g.* a vascular vessel. ↑ CONSTRICTOR (Cn)

FB060 monogastric (*adj.*) Describes a muscle with only one venter. ↓ DIGASTRIC · POLYGASTRIC · BIVENTRAL ↑ MOTOR[2] · VENTER[2]

FB061 digastric (*adj.*) Describes a muscle with two venters, *i.e.* it is fleshy at both ends and tendinous in the middle. ↑ MONOGASTRIC

FB062 polygastric (*adj.*) Describes a muscle with more than two venters. ↑ MONOGASTRIC

FB063 biventral (*adj.*) Alternative term for DIGASTRIC (↑).

FB064 extrinsic (*adj.*) Describes a muscle that acts between two separate structures of a body, *e.g.* a muscle with its origin in the body and its insertion in a limb is an extrinsic muscle. ↓ INTRINSIC · ANTAGONISTIC ↑ MOTOR[2]

FB065 intrinsic (*adj.*) Describes a muscle which acts completely within the same structure of a body, *e.g.* the muscle of the face acting between the bone of the skull and the flesh of the face. ↑ EXTRINSIC

FB066 antagonistic (*adj.*) Describes a muscle acting in opposition to another muscle so that the opposite action is performed, *e.g.* a flexor and an extensor are antagonistic to each other. All muscles producing articulation are found in antagonistic pairs or in antagonistic arrangements of more than two muscles □ *the biceps muscle in the arm is antagonistic to the triceps* ↑ EXTRINSIC

FB067 abducent (*adj.*) Describes a muscle which draws an appendage away from the median axis. ↑ MOTOR[2]

FB068 biceps (*n.*) A muscle with two heads or two origins. ↓ BICEPS BRACHII · BICEPS FEMORIS · TRICEPS · TRAPEZIUS · SPHINCTER ↑ MOVEMENT

FB069 biceps brachii (*n.*) This muscle has one origin on the coracoid process and one in the capsule of the shoulder joint; the insertion is on the radius. It is a supinator of the fore-arm and flexes the elbow.

FB070 biceps femoris (*n.*) This muscle has one origin on the ischium and one on the femur; it has an insertion on the fibula, and a small slip to an insertion on the tibia.

FB071 triceps (*n.*) This muscle has two origins on the humerus and one on the scapula; the insertion is on the olecranon. It is the

extensor of the elbow and is antagonistic to the biceps. ↓ QUADRICEPS ↑ BICEPS

FB072 quadriceps (*n.*) A muscle with four heads, *i.e.* having four origins; it lies in front of the thigh and extends to the lower leg. ↑ TRICEPS

FB073 trapezius (*n.*) One of the two broad, flat, triangular muscles of the neck and shoulders. ↑ BICEPS

FB074 sphincter (*n.*) A circular muscle which on contraction closes an orifice, *e.g.* ***a*** the pyloric sphincter closes the tube leading from the stomach to the duodenum; ***b*** the sphincter ani closing the anus. ↑ BICEPS

Locomotion

FC001 locomotion (*n.*) The action of an individual organism in moving itself from place to place; this ability is usually restricted to animals. Locomotion of an organism is brought about by movements of parts of the body. Methods of locomotion include running, walking, flying, and swimming. —LOCOMOTOR (*n.*) LOCOMOTIVE (*adj.*) ↓ LOCOMOTOR · FLAGELLA[1] · QUADRUPED · FLIGHT · CHASE · WRIGGLE · UNGULIGRADE PINNIGRADE · OAR · GAIT · WALK · SPRING · ROW · FLAP[2] · UNDULATORY · STREAMLINED · ISOPODOUS → MOVEMENT · MUSCLE · SKELETON

FC002 locomotor (*n.*) An organ or tissues used for locomotion, *e.g.* the hind limbs of the frog and the tail of a fish are locomotor organs. ↑ LOCOMOTION

FC003 euglenoid movement (*n.*) A form of locomotion in Euglenophyta. ↑ LOCOMOTOR ↓ METACHRONAL RHYTHM → EUGLENOPHYTA

FC004 metachronal rhythm (*n.*) The pattern of movement of cilia or of multiple limbs. If the effective stroke is backward, then each cilium or limb is at a later stage of movement than the one in front of it and at an earlier stage than the one behind it. The effective movement appears as a wave-like motion moving forwards in the cilia or limbs. ↑ LOCOMOTOR

FC005 flagella[1] (*n.pl.*) See FLAGELLUM. ↓ PODIUM · PARAPODIUM · PSEUDOPODIUM[2] · TUBE FOOT · PROLEG · CTENE ↑ LOCOMOTION → FLAGELLUM

FC006 podium (*n.,pl.* **podia**) **1** Any structure resembling a foot in its function. **2** Alternative term for TUBE FOOT. ↓ TUBE FOOT ↑ FLAGELLA[1]

FC007 parapodium (*n.,pl.* **parapodia**) One of a pair of leaf-like muscular locomotor organs on the body wall of polychaeta; each segment possesses a pair. The parapodia are used to paddle the worm through water. ↑ FLAGELLA[1]

FC008 pseudopodium[2] (*n.,pl.* **pseudopodia**) A temporary protrusion, of no fixed outline, from the cell of certain protozoa (Rhizopodia), *e.g. Amoeba.* Protoplasm flows into and out of the pseudopodium, changing its shape. A pseudopodium provides a means of locomotion (amoeboid movement), and a means of feeding (by engulfing). —***pseudopodal*** (*adj.*) ↑ FLAGELLA[1] → PELLICLE

FC009 tube foot (*n.*) One of many muscular, tubular structures projecting from the ventral side of an arm of certain echinoderms, *e.g.* starfish; they are connected to the water vascular system. Hydrostatic pressure and muscular contraction produce movement of the foot; a terminal disc acts as a suction cup to anchor the foot to the substrate. Locomotion is produced by the tube foot pivoting on the terminal disc and pushing the animal forward. In certain echinoderms, *e.g.* holothurians and crinoids, they are modified for feeding. ↑ FLAGELLA[1] → WATER VASCULAR SYSTEM

FC010 proleg (*n.*) A short thick appendage without joints, borne on the abdominal surface of some arthropod larvae. ↑ FLAGELLA[1]

FC011 ctene (*n.*) The swimming plate of ctenophores, consisting of rows of cilia fused together at their bases to form a band, with a structure like a comb. ↑ FLAGELLA[1] → CTENOPHORA

FC012 quadruped (*n.*) An animal possessing and walking on two pairs of pentadactyl limbs, *i.e.* walking on four feet. —***quadrupedal*** (*adj.*) ↓ BIPED ↑ LOCOMOTION

FC013 biped (*n.*) An animal possessing two pairs of pentadactyl limbs and habitually walking on only one pair, *i.e.* walking on two feet. —***bipedal*** (*adj.*) ↑ QUADRUPED

FC014 flight (*n.*) The action of flying. ↓ PERCH[1] ↑ LOCOMOTION

FC015 perch[1] (*n.*) A place used by birds for perching. ↓ PERCH[2] ↑ FLIGHT

FC016 chase (*v.t.*) To run after prey in order to kill and eat it, *e.g.* a lion chases a zebra, its usual prey. —CHASE (*n.*) ↓ FLEE · PERCH[2] ↑ LOCOMOTION

FC017 flee (*v.i.*) **(fled, fled)** (Of prey) to run away from a predator; (of animals generally) to run away from danger □ *to flee from a natural enemy* —FLIGHT (*n.*) ↑ CHASE

FC018 perch[2] (*v.i.*) (Of a bird) to rest on a branch of a tree, or other similar rod-like structure, by gripping the branch with its four toes. ↑ CHASE

FC019 wriggle (*v.i.*) **1** (G.S.) (Of the body of an animal) to turn and twist in response to a stimulus. **2** (Of small vermiform animals) to move by turning and twisting so as to achieve locomotion in water or on land, but not in a definite direction. **3** A method of locomotion in water or on land of small vermiform animals; by continuous wriggling

they achieve locomotion in an indefinite direction. —***wriggler*** (*n.*) WRIGGLE (*n.*) ↓ LOOP[2] ↑ LOCOMOTION

FC020 loop[2] (*v.i.*) **1** (Of small, long, thin animals) to move by twisting in the form of a loop. **2** (Of hydroids) to form loops as a method of locomotion; the hydroid fixes its tentacles to a weed, draws its foot close by the tentacles, and forms a loop with its body. It then repeats the process, having moved its tentacles a little further along the weed. In this manner, it moves slowly in a definite direction. —***looping*** (*n.*) ***loop*** (*n.*) ↑ WRIGGLE

FC021 unguligrade (*adj.*) Walking or running on hooves, or the tips of one or more digits, *e.g.* horses and cattle have unguligrade locomotion □ *horses have unguligrade feet* ↓ DIGITIGRADE · PLANTIGRADE · SALTIGRADE · DORSIGRADE ↑ LOCOMOTION → HOOF · DIGIT

FC022 digitigrade (*adj.*) Walking on all the digits of a limb, *e.g.* cats and dogs have digitigrade locomotion. ↑ UNGULIGRADE

FC023 plantigrade (*adj.*)Walking on the whole sole of the foot, *e.g.* men and bears have plantigrade locomotion □ *rodents have plantigrade feet* ↑ UNGULIGRADE

FC024 saltigrade (*adj.*) Describes locomotion by leaps, as in some insects and spiders, and in the marsupial mammals. ↑ UNGULIGRADE

FC025 dorsigrade (*adj.*) Describes locomotion with the back of the digit on the ground, usually when walking. ↑ UNGULIGRADE

FC026 pinnigrade (*adj.*) Producing a swimming movement by using flippers as paddles. ↓ SYRINGOGRADE ↑ LOCOMOTION

FC027 syringograde (*adj.*) Describes an organism which is propelled by a jet of water; the locomotion is effected by alternate suction and ejection of water through siphons. This method of locomotion is also known as ***jet propulsion.*** ↑ PINNIGRADE

FC028 oar (*n.*) **1** (G.S.) A long shaft with a flat blade at the end used to propel a boat. The blade of the oar remains stationary in the water, and when the shaft is pulled, the shaft pushes against a support on the boat and propels the boat; this is the action of **rowing. 2** An animal structure that acts in a similar way to cause locomotion, *e.g.* the oar-like setae on an earthworm propel the animal through the earth. ↓ PADDLE[1] · FLIPPER · SYNDACTYLY · ROW ↑ LOCOMOTION

FC029 paddle[1] (*n.*) **1** A kind of short oar with a broad blade; the focus is on the broad shape of the blade. **2** A limb of an aquatic animal of which the distal end has a paddle shape, *i.e.* it is flat and broad. The paddle is used to propel the animal through water, *e.g.* ***a*** the paddles on aquatic insects on the distal ends of their jointed legs; ***b*** the paddles on seals, in which the limb is broad, with small digits at the terminal end. —PADDLE[2] (*v.*) ↑ OAR

FC030 flipper (*n.*) A limb of an aquatic bird or mammal used for swimming; a flipper is longer and thinner than a paddle; it does not possess digits. ↑ OAR

FC031 syndactyly (*n.*) A condition in which two or more digits are fully or partly joined, either naturally, as in the webbed feet of amphibians and birds, or abnormally as a result of genetic mutation. ↑ OAR → MUTATION · PINNATIPED

FC032 gait (*n.*) The way in which an animal walks or runs on two or four feet. ↑ LOCOMOTION

FC033 walk (*v.i.*) To move by the slowest method of locomotion for bipeds and quadrupeds, and the method of locomotion for all other animals with more than four legs. In walking, only one leg is moved at a time. ↓ RUN · FLY · FALL · GALLOP ↑ LOCOMOTION

FC034 run (*v.i.*) **(ran, run)** To move by the fastest method of locomotion for bipeds and the smaller quadrupeds, *e.g.* dogs, rats, etc. In running, quick steps are taken, and for bipeds both feet may be momentarily off the ground. ↑ WALK

FC035 fly (*v.i.*) **(flew, flown)** To move through the air by the use of wings. ↑ WALK

FC036 fall (*v.i.*) **(fell, fallen)** To go down from an upright position, from any form of locomotion, or from a height, under the force of gravity, *e.g.* ***a*** the bird fell from its nest to the ground; ***b*** the man fell while running and hit his face on the ground. ↑ WALK

FC037 gallop (*v.i.*) To move by the fastest method of locomotion for larger quadrupeds, *e.g.* horses. In galloping, all four feet can be off the ground at the same time, with usually back legs and front legs moving as a pair at the same time. ↑ WALK

FC038 spring (*v.i.*) To make a leap; before making the action, the limbs are flexed to their fullest extent so that more effort can be put into the action, *e.g.* a cat crouches down before springing onto a bird. ↓ LEAP · SOMERSAULT · BOUND[2] · HOP · JUMP · LOPE ↑ LOCOMOTION → PENTADACTYL LIMB

FC039 leap (*v.i.*) To jump upwards and forwards from one position to another, *e.g.* a tiger leaps upon a goat. —LEAP (*n.*) ↑ SPRING

FC040 somersault (*v.i.*) **1** (G.S.) To jump up and turn the body, putting the feet above the head, and to continue the turning movement and land on the feet. **2** (Of hydroids) to turn in this way as a method of locomotion; the hydroid fixes its tentacles to a weed, raises its foot above the tentacles, puts its foot down on the far side, then raises its tentacles above its foot, and puts its tentacles down on the far side, thus continually turning over and over and moving in a definite direction by repeating the somersaults. —***somersault*** (*n.*) ↑ SPRING

FC041 bound[2] (*v.i.*) To move forward by a series of long jumps; the movement is an equivalent of running, but with the hind legs moving in the same way at the same time, *e.g.* a kangaroo bounds along a path. ↑ SPRING

FC042 hop (*v.i.*) **1** (Of mammalian bipeds) to jump on one foot. **2** (Of amphibians and birds) to move forward by a series of jumps. The movement is the same as *bounding*, but the jumps are shorter, and the duration of

the action is shorter, *e.g.* when a frog hops from a stone to a pool, the motion is slower than in bounding, and the distance is short. ↑ SPRING

FC043 jump (*v.i.*) To force the body up into the air by flexing and then quickly straightening the legs. ↑ SPRING

FC044 lope (*v.i.*)(Of certain quadrupeds) to move with long steps—a kind of action between walking and running, *e.g.* a dog lopes along a path when going from one place to another. ↑ SPRING

FC045 row (*v.t.,i.*) To propel a boat through water with an oar; the term implies vigorous effort. ↓ PADDLE[2] · SWIM · STEER · VEER ↑ LOCOMOTION · OAR

FC046 paddle[2] (*v.t.,i.*) **1** (G.S.) To propel a boat with a paddle; no support on the boat is used. The paddle is pushed backwards; the blade remains stationary in the water while the boat moves forward. **2** (Of an aquatic animal or any mammal in water) to use its limbs in the manner of a paddle to propel itself through water; the limb can be a flipper, a paddle, an arm, or a leg. To paddle implies less speed and effort than to **swim**. A fish occasionally uses its pectoral fin to paddle, but the resulting motion is slow. ↑ ROW → FIN

FC047 swim (*v.i.*) **(swam, swum)** To move through water by the use of fins or other appendages. ↑ ROW

FC048 steer (*v.t.,i.*) To direct the motion of a boat or a fish in water, by a rudder or a tail. ↑ ROW

FC049 veer (*v.i.*) To change direction while moving forward, *e.g.* the car veered to the left to avoid the dog. The term implies a gradual change in direction while moving quickly. ↑ ROW

FC050 flap[2] (*v.t.,i.*) To move wings up and down. When flying, the movement of a wing is in a figure of eight, so that the downward stroke both lifts and propels the bird; on the upward stroke the wing has little resistance to the air. ↓ GLIDE · SOAR · SLIDE ↑ LOCOMOTION → WING

FC051 glide (*v.i.*) **1** (Of birds or insects) to move forward with wings extended stiffly at a speed that provides an upward thrust on the wing, preventing rapid loss of height. **2** To move over a surface or through water in a manner similar to a bird gliding, *i.e.* without up and down movement of the body as in walking or running, *e.g.* ***a*** movement of cilia causes a planarian to glide along the surface of a stone or of mud; ***b*** a snake glides over the ground. ↑ FLAP[2]

FC052 soar (*v.i.*) (Of birds) to be lifted by a rising current of hot air with wings extended as in gliding. ↑ FLAP[2]

FC053 slide (*v.t.,i.*) **(slid, slid)** To move down a smooth surface under the force of gravity, either as a means of locomotion, or as a means of moving an object, *e.g.* ***a*** he slid down the side of the mountain; ***b*** he slid the box down the plank from the lorry to the ground. ↑ FLAP[2]

FC054 undulatory[2] (*adj.*) Describes a movement in the form of a wave passing along the length of an animal, *e.g.* the movement of a snake or the movement of a fish when swimming. —UNDULATE (*v.*) UNDULATION (*n.*) ↑ LOCOMOTION

FC055 streamlined (*adj.*) Describes a shape which allows fluid to flow fast and to maintain streamline flow around it, *i.e.* as it tapers off at both ends in the direction of flow the shape offers minimum resistance, *e.g.* the streamlined shape of a fish or a bird offers minimum resistance to the surrounding water or air. ↑ LOCOMOTION

FC056 isopodous (*adj.*) Describes legs for walking which are alike and equal in all respects, *e.g.* in size, shape, and direction of movement. ↓ PINNATIPED · PREHENSILE ↑ LOCOMOTION

FC057 pinnatiped (*adj.*) Having toes joined by skin or flesh to make them more useful when swimming, *e.g.* ***a*** a flipper is a pinnatiped limb; webbed feet are pinnatiped. ↑ ISOPODOUS

FC058 prehensile (*adj.*) (Of an appendage) adapted for gripping an object, *e.g.* a prehensile tail, used by monkeys for gripping a branch. ↑ ISOPODOUS

Sensitivity

FD001 sensitivity[1] (*n.*) The disposition of a living organism, or part of it, to perceive and respond to a physical stimulus. Compare **irritability,** which has a wider meaning and includes response to other organisms and the behaviour of other organisms, as well as response to physical stimuli. ↓ TAXIS · TROPISM · KINESIS · NASTY · DIURNAL RHYTHM → IRRITABILITY · MOVEMENT

FD002 taxis (*n., pl.* **taxes**) The locomotory movement of a motile organism, usually an animal or a gamete, in response to a directional physical stimulus. A positive taxis is locomotion towards the stimulus; a negative taxis is locomotion away from the stimulus. If the stimulus can form a gradient, such as temperature, then a positive taxis is directed towards a positive gradient, and a negative taxis towards a negative gradient. The taxis is defined by the direction of locomotion, rather than by speed (its **kinesis**) □ *an organism exhibits a positive taxis, i.e. it makes a useful (positive) response* —TACTIC (*adj.*) ↓ PHOTOTAXIS · TOPOTAXIS · PHOBOTAXIS · STEREOTAXIS · TACTIC · PHOTOPHILOUS ↑ SENSITIVITY[1] → KINESIS

FD003 phototaxis (*n.*) Locomotory movement of a motile organism towards (positive phototaxis) or away from (negative phototaxis) a directed source of light, *e.g.* Hydra exhibit negative phototaxis towards a beam of light. —***phototactic*** (*adj.*) ↓ GEOTAXIS · HYDROTAXIS · CHEMOTAXIS · THERMOTAXIS · THIGMOTAXIS · SEISMOTAXIS · RHEOTAXIS · GALVANOTAXIS · PHOTOKINESIS ↑ TAXIS

FD004 geotaxis (*n.*) A taxis in response to the force of gravity, *e.g.* flatworms on a sloping surface move downwards (**positive geotaxis**). —***geotactic*** (*adj.*) ↑ PHOTOTAXIS

FD005 hydrotaxis (*n.*) A taxis in response to the stimulus of water or of moisture. —***hydrotactic*** (*adj.*) ↓ HYGROKINESIS ↑ PHOTOTAXIS

FD006 chemotaxis (*n.*) A taxis in response to a gradient in chemical concentrations, *e.g. Amoeba* moves away from a high concentration of carbon dioxide dissolved in water. —***chemotactic*** (*adj.*) ↓ TROPHOTAXIS (H) · CHEMOKINESIS ↑ PHOTOTAXIS

FD007 thermotaxis (*n.*) A taxis under the stimulus of temperature, *e.g. Paramecium* exhibits positive thermotaxis towards moderate warmth, *i.e. Paramecium* moves from a location of lower temperature to a location of moderate warmth (15°–25°C). —***thermotactic*** (*adj.*) ↓ THERMOKINESIS ↑ PHOTOTAXIS

FD008 thigmotaxis (*n.*) A taxis in response to the touch of a solid body, *e.g.* ***a*** the tendency of micro-organisms to attach themselves to solid objects on making contact; ***b*** the tendency of small animals to move into cracks and crevices. —***thigmotactic*** (*adj.*) ↓ THIGMOKINESIS ↑ PHOTOTAXIS

FD009 seismotaxis (*n.*) A taxis in response to mechanical vibration, *e.g.* the tapping of a bowl containing sugar on which ants are feeding causes the ants to leave the bowl. —***seismotactic*** (*adj.*) ↑ PHOTOTAXIS

FD010 rheotaxis (*n.*) A taxis in response to a current of water or air, *e.g.* fishes and planarians usually move against a current in water. —***rheotactic*** (*adj.*) ↑ PHOTOTAXIS

FD011 galvanotaxis (*n.*) A taxis in response to an electric current, *e.g. Paramecium* moves towards the negative electrode when a direct current is passed through water. —***galvanotactic*** (*adj.*) ↑ PHOTOTAXIS

FD012 topotaxis (*n.*) A directed or automatic locomotory response to spatial differences in intensity of stimulation, *i.e.* a motile organism moves towards the spatial stimulus. —***topotactic*** (*adj.*) ↓ TELOTAXIS (H) · MENOTAXIS (H) · TROPOTAXIS (H) · MNEMOTAXIS (H) · TROPHOTAXIS · PHOBOTAXIS (An) ↑ TAXIS

FD013 telotaxis (*n.*) The locomotory movement of a motile organism along a line between the organism and the source of the stimulus; goal-orientation. —***telotactic*** (*adj.*) ↑ TOPOTAXIS

FD014 menotaxis (*n.*) The compensatory movements made by an animal or motile organism to maintain the orientation of its body axis in a given direction in relation to a sensory stimulus. —***menotactic*** (*adj.*) ↑ TOPOTAXIS

FD015 tropotaxis (*n.*) The orientation of a mobile organism such that symmetrically placed sense organs receive a directed stimulus with equal intensity. —***tropotactic*** (*adj.*) ↑ TOPOTAXIS

FD016 mnemotaxis (*n.*) The locomotory motion of an animal directed by the stimulus of memory, *e.g.* ***a*** the homing of birds (their ability to fly back to their usual home); ***b*** the way in which animals return to a particular feeding place. —***mnemotactic*** (*adj.*) ↑ TOPOTAXIS

FD017 trophotaxis (*n.*) Locomotory movement by a mobile organism in response to an object which may serve as food; a form of chemotaxis. —***trophotactic*** (*adj.*) ↑ CHEMOTAXIS · TOPOTAXIS

FD018 phobotaxis (*n.*) The locomotory movement of a motile organism away from a stimulus; it is essentially an avoiding response or a 'trial and error' response. —***phobotactic*** (*adj.*) ↓ PHOTOPHOBIA · PHOTOPHOBE ↑ TAXIS · TOPOTAXIS (An)

FD019 photophobia (*n.*) (In motile organisms) the characteristic of avoiding light. ↑ PHOBOTAXIS

FD020 photophobe (*n.*) A motile organism that moves away from light. —PHOTOPHOBIA (*n.*) PHOTOPHOBIC (*adj.*) ↓ PHOTOPHILE (An) ↑ PHOBOTAXIS → SKOTOPHILE (Sn)

FD021 stereotaxis (*n.*) Alternative term for THIGMOTAXIS (↑).

FD022 tactic (*adj.*) Describes either locomotory movements caused by stimuli, or the agent of stimulation causing the movement, *e.g.* a movement by a motile organism away from an obstacle is a tactic movement; the obstacle is also a tactic object. The term can be preceded by any of the prefixes used to describe a specific kind of stimulus, *e.g.* phototactic (movement related to light), thigmotactic (movement related to contact) □ *a stimulus provokes a tactic movement* ↓ TROPIC · KINETIC · NASTIC ↑ TAXIS

FD023 photophilous (*adj.*) Describes an organism that seeks strong light or thrives in strong light. ↓ PHOTOPHOBIC (An) ↑ TAXIS

FD024 photophobic (*adj.*) Describes a photophobe. ↑ PHOTOPHILOUS (An)

FD025 tropism (*n.*) The directional growth curvature of a plant or sedentary animal in response to a unidirectional physical stimulus. The direction of curvature is determined by the direction of the stimulus; a positive tropism curves towards the stimulus; a negative tropism curves away from the stimulus. Examples of stimuli are light, gravity, water, humidity, chemical substances, and water current □ *a plant exhibits a tropism* —TROPIC (*adj.*) ↓ PHOTOTROPISM · HELIOTROPISM · TROPIC ↑ SENSITIVITY[1]

FD026 phototropism (*n.*) A tropism in response to light, *e g.* the growth curvature of plant stems towards light. The stems bend because cells in the growth region are elon-

gated on the side of the stem shaded from the light. —***phototropic*** (*adj.*) ↓ GEOTROPISM · HYDROTROPISM · CHEMOTROPISM · THERMOTROPISM · THIGMOTROPISM · TRAUMATROPISM · RHEOTROPISM · GALVANOTROPISM · PHOTONASTY ↑ TROPISM

FD027 geotropism (*n.*) A tropism in response to the force of gravity, *e.g.* plant stems grow upwards, exhibiting negative geotropism, while roots grow downwards, exhibiting positive geotropism. —***geotropic*** (*adj.*) ↑ PHOTOTROPISM

FD028 hydrotropism (*n.*) A tropism in response to the stimulus of water or of moisture, *e.g.* the roots of a plant tend to grow by growth curvature towards water, or towards a region of more moisture (positive hydrotropism). —***hydrotropic*** ↓ HYDRONASTY ↑ PHOTOTROPISM

FD029 chemotropism (*n.*) A tropism in response to a gradient of chemical concentration, *e.g.* ***a*** pollen tubes grow towards ovules (positive chemotaxis arising from substances secreted by the ovules and stigma); pollen tubes grow away from the atmospheric oxygen (negative chemotaxis); ***b*** plant roots grow towards a greater concentration of nutrients in the soil. —***chemotropic*** ↓ TROPHOTROPISM (H) · CHEMONASTY ↑ PHOTOTROPISM

FD030 thermotropism (*n.*) A tropism in response to variation in temperature; the movement of a sunflower orienting itself towards the sun is possibly an example of thermotropism, although it may be phototropism or a combination of both. —***thermotrophic*** (*adj.*) ↓ THERMONASTY ↑ PHOTOTROPISM

FD031 thigmotropism (*n.*) A tropism in response to the touch of a solid body. Thigmotropism is exhibited by the tendrils of a climbing plant; the contact made by the tendril causes it to curve round and coil itself round any solid object it touches. The reaction of a climbing stem, *e.g.* the stem of some legumes, is similar. —***thigmotropic*** (*adj.*) ↓ THIGMONASTY ↑ PHOTOTROPISM

FD032 traumatropism (*n.*) The curving of plants during growth caused by a wound. ↑ PHOTOTROPISM

FD033 rheotropism (*n.*) A tropism in response to a current of air or a current of water. —***rheotropic*** (*adj.*) ↑ PHOTOTROPISM

FD034 galvanotropism (*n.*) A tropism in response to an electric current. —***galvanotropic*** (*adj.*) ↑ PHOTOTROPISM

FD035 heliotropism (*n.*) A tropism in response to sunlight; a less common term for phototropism. —***heliotropic*** (*adj.*) ↓ STEREOTROPISM · HAPTOTROPISM · TROPHOTROPISM · DIAGEOTROPISM ↑ TROPISM

FD036 stereotropism (*n.*) Alternative term for THIGMOTROPISM (↑).

FD037 haptotropism (*n.*) Alternative term for THIGMOTROPISM (↑).

FD038 trophotropism (*n.*) The directional growth curvature of a plant or sedentary animal towards a food supply; a form of chemotropism. —***trophotropic*** (*adj.*) ↑ HELIOTROPISM · CHEMOTROPISM

FD039 diageotropism (*n.*) A tendency in certain parts of plants, such as rhizomes, to grow at right angles to the direction of gravity. ↑ HELIOTROPISM

FD040 tropic (*adj.*) Describes either growth curvatures in a plant caused by physical stimuli or the agent of stimulus causing the growth, *e.g.* the curvature of stems towards light is a tropic growth; the light is a tropic agent. The term can be preceded by any of the prefixes which relate to a specific stimulus, *e.g.* phototropic (related to light), thigmotropic (related to contact) ↓ KINETIC · NASTIC ↑ TACTIC · TROPISM

FD041 paratonic (*adj.*) Describes plant movements caused by external stimuli, *e.g.* tropisms and nastic movements. ↑ TROPIC

FD042 kinesis (*n., pl.* **kineses**) The random locomotory movement of a motile organism, or cell, in response to a diffuse physical stimulus. A positive kinesis is an increase in the speed of locomotion or in the frequency of turning as the intensity of the stimulus increases. A negative kinesis is a decrease in these quantities as the intensity of the stimulus increases. The kinesis is defined by the change in speed or frequency of turning, and not by the direction of movement (this is a taxis). A kinesis often results in an aggregation of organisms at an optimum position for the stimulus; this is frequently superficially similar to a taxis □ *organisms exhibit a kinesis* —KINETIC (*adj.*) ↓ PHOTOKINESIS · KINETIC ↑ SENSITIVITY[1]

FD043 photokinesis (*n.*) A kinesis in response to stimulation by certain regions of the visible spectrum; this often results in an aggregation of organisms around the light source; this effect does not depend on the direction of the light. —***photokinetic*** (*adj.*) ↓ HYGROKINESIS · CHEMOKINESIS · THERMOKINESIS · THIGMOKINESIS · STEREOKINESIS ↑ PHOTOTAXIS · KINESIS

FD044 hygrokinesis (*n.*) A kinesis in response to a change in humidity or to a humidity gradient, *e.g.* woodlice are active in low humidity but come to rest in a moist atmosphere; if woodlice are placed between a region of high humidity and a region of low humidity, they aggregate in the region of high humidity. —***hygrokinetic*** (*adj.*) ↑ HYDROTAXIS · PHOTOKINESIS

FD045 chemokinesis (*n.*) A kinesis in response to a chemical stimulus, *e.g.* ether in water slows down ciliary movement of *Paramecium* (negative chemokinesis) and hence its speed of locomotion; *Paramecium* aggregates in a region of preferred (**eccritic**) concentration of carbon dioxide. —***chemokinetic*** (*adj.*) ↑ CHEMOTAXIS · PHOTOKINESIS

FD046 thermokinesis (*n.*) A kinesis in response to a stimulation from a temperature gradient, *e.g.* if blowflies are placed on an opaque screen heated by an electric lamp the blowflies aggregate round the lamp in a zone of preferred (**eccritic**) temperature. This superficially resembles a taxis, but the movement is not undirec-

tional. —***thermokinetic*** (*adj.*) ↑ THERMOTAXIS · PHOTOKINESIS

FD047 thigmokinesis (*n.*) Locomotory movement or inhibition of movement by a motile organism in response to a stimulation by touch, *e.g.* an amoeba pricked with a needle first inhibits movement by withdrawing its pseudopodia, *i.e.* it exhibits negative thigmokinesis. —***thigmokinetic*** (*adj.*) ↑ THIGMOTAXIS · PHOTOKINESIS

FD048 stereokinesis (*n.*) Alternative term for THIGMOKINESIS.

FD049 kinetic (*adj.*) Describes the random locomotory movements or turning of motile organisms caused by a diffuse stimulus, *e.g.* aggregation of organisms at a preferred temperature zone is a kinetic movement. The term can be preceded by any of the prefixes which relate to a specific stimulus, *e.g. photokinetic, hygrokinetic.* ↓ NASTIC ↑ TACTIC · TROPIC · KINESIS

FD050 nasty (*n.*) A non-directional change in a plant in response to a diffuse physical stimulus, *e.g.* the folding of leaves in hot weather; the opening and closing of flowers in response to the intensity of light; the closing of leaves, such as those of mimosa, when touched. —NASTIC (*adj.*) ↓ PHOTONASTY · NASTIC ↑ SENSITIVITY[1]

FD051 photonasty (*n.*) A nasty in response to a change in the intensity of light, *e.g.* flowers open in the presence of light and close in its absence. Photonasty does not depend on the direction in which the light travels from its source. —***photonastic*** (*adj.*) ↓ NYCTINASTY · HYDRONASTY · CHEMONASTY · THERMONASTY · THIGMONASTY · SEISMONASTY ↑ PHOTOTROPISM · NASTY

FD052 nyctinasty (*n.*) (In plants) movements during sleep when leaves droop and fold in response to darkness. ↑ PHOTONASTY

FD053 hydronasty (*n.*) A nasty in response to the stimulus of atmospheric moisture, *e.g.* the awn of an oat twists and untwists with changes in atmospheric humidity. —***hydronastic*** (*adj.*) ↑ HYDROTROPISM · PHOTONASTY

FD054 chemonasty (*n.*) A nasty in response to a chemical stimulus, *e.g.* the modified structures of insectivorous plants respond by contraction to the stimulus of nitrogenous substances, in order to trap the substance for food. —***chemonastic*** (*adj.*) ↑ CHEMOTROPISM · PHOTONASTY

FD055 thermonasty (*n.*) A nasty in response to a general non-directional temperature variation, *e.g.* tulip flowers exhibit a positive thermonasty, as they open with increasing temperature and close with decreasing temperature. —***thermonastic*** (*adj.*) ↑ THERMOTROPISM · PHOTONASTY

FD056 thigmonasty (*n.*) A nasty in response to the stimulation of touch, *e.g.* the reaction of the leaflets of a mimosa plant to a light touch; the leaflets fold up, but return to their former position after a period of time. —***thigmonastic*** (*adj.*) ↑ THIGMOTROPISM · PHOTONASTY

FD057 seismonasty (*n.*) A nasty in response to a non-directional mechanical shock or mechanical vibration, *e.g.* the rapid folding of leaflets and stem of mimosa when the plant is struck. Seismonasty and thigmonasty are not always clearly separable, as the response depends on the intensity of the force, and on the individual organism. —***seismonastic*** (*adj.*) ↑ PHOTONASTY

FD058 nastic (*adj.*) Describes the movements of parts of plants in response to diffuse stimuli, *e.g.* the opening and closing of the flowers of some plants at a critical temperature is a nastic movement. ↑ TACTIC · TROPIC · KINETIC

FD059 diurnal rhythm (*n.*) Rhythmic changes which take place in the activity of an organism during a period of approximately 24 hours. The rhythm arises within the organism and is independent of external factors, as it continues when the organism is isolated from the daily rhythmic changes in the environment, *e.g.* ***a*** the alternation of sleep and activity in animals has a rhythm based on a day; the rhythm continues when the animal is isolated from its environment; ***b*** growth and leaf movements of plants similarly have a rhythm based on a day. Diurnal rhythm in plants is thought to be the basis of photoperiodism. The diurnal rhythm has two phases, one in the light (photophile), and one in the dark (skotophile). ↓ PHOTOPERIOD · THERMOPHILE · DIURNAL[1] · ENDOGENOUS · EXOGENOUS ↑ SENSITIVITY[1]

FD060 photoperiod (*n.*) The number of hours of daylight in a day, *e.g.* if the photoperiod of a day is 10 hours, then there are 10 hours of daylight and 14 hours of darkness. —PHOTOPERIODISM (*n.*) ***photoperiodic*** (*adj.*) ↓ PHOTOPERIODISM · CIRCADIAN RHYTHM · SKOTOPHILE · PHOTOPHILE · PHENOLOGY ↑ DIURNAL RHYTHM

FD061 photoperiodism (*n.*) The response of organisms to the relative duration of day and night, *i.e.* to the greater or smaller number of hours of daylight. Some species of plants require a shorter period of daylight for their optimum functioning, others require a longer period, while others are intermediate. For most plants the critical photoperiod is between 12 and 14 hours. Photoperiodism is also of fundamental importance in some insects for the control of diapause, reproductive activity, etc. ↑ PHOTOPERIOD → DIAPAUSE

FD062 circadian rhythm (*n.*) Alternative term for DIURNAL RHYTHM (↑).

FD063 skotophile (*n.*) **1** An organism that prefers darkness to light. **2** (In diurnal rhythm) the dark receptive phase of a plant. ↑ PHOTOPERIOD · DIURNAL RHYTHM

FD064 photophile (*n.*) (In diurnal rhythm) the light receptive phase of a plant. ↑ PHOTOPERIOD

FD065 phenology (*n.*) **1** The study of periodicity in plants, insects, birds, etc., such as the study of the opening and closing of flowers, the cycle of flowering in relation to climate, and other periodic phenomena. ↑ PHOTOPERIOD

FD066 thermophile (*n.*) An organism that thrives at relatively high temperatures, *e.g.* certain types of bacteria thrive above 45°C. —THERMOPHILIC[2] (*adj.*) ↑ DIURNAL RHYTHM

FD067 diurnal[1] (*adj.*) **1** Describes an organism active during the hours of daylight, *e.g.* a diurnal animal seeks its food during daylight. **2** Describes events taking place every day, as in diurnal rhythm. ↓ NOCTURNAL (An) · THERMOPHILIC[2] · THERMOPHIL ↑ DIURNAL RHYTHM

FD068 nocturnal (*adj.*) **1** Active during the hours of darkness, *e.g.* ***a*** a nocturnal animal seeks its food by night; ***b*** an animal has nocturnal habits if it is active by night. **2** Describes an event that takes place at night. ↑ DIURNAL[1] (An)

FD069 thermophilic[2] (*adj.*) (Of microorganisms) having an optimum temperature for growth above 45°C. —THERMOPHILE (*n.*) ↑ DIURNAL[1]

FD070 thermophil (*adj.*) Alternative term for THERMOPHILIC (↑).

FD071 endogenous (*adj.*) **1** Describes energy, activities, or processes, arising solely within an organism or part of an organism, or within a cell, and not having any external cause, *e.g.* ***a*** the energy of a nervous impulse is endogenous; ***b*** diurnal rhythm consists of endogenous rhythmic changes. **2** Developing from deep-seated tissues associated with growth. ↓ AUTOGENIC · AUTOGENOUS · AUTONOMIC · SPONTANEOUS · EXOGENOUS (An) · ALLOGENOUS (An) ↑ DIURNAL RHYTHM

FD072 autogenic (*adj.*) Describes an activity or process caused by the actions or processes of organisms themselves, *e.g.* the succession of plant-seed-plant is an autogenic process. ↓ ECTOGENIC (An) · ALLOGENIC (An) · AUTONOMIC (Sn) · SPONTANEOUS (Sn) ↑ ENDOGENOUS

FD073 autogenous (*adj.*) Of or to do with any product produced and used by an organism itself, *e.g.* ***a*** digestive enzymes are autogenous products; ***b*** if bacteria are taken from an animal to prepare a vaccine, and the vaccine is used on the same animal, it is an autogenous vaccine. ↓ ALLOGENOUS (An) ↑ ENDOGENOUS

FD074 autonomic (*adj.*) Describes an organism controlling itself by internal stimuli, *e.g.* ***a*** processes of growth in organisms are autonomic; ***b*** the development of organs in animals during growth depends on internal stimuli and is autonomic; ***c*** the unfolding of buds on plants is an autonomic process. ↓ ECTOGENIC (An) ↑ ENDOGENOUS · AUTOGENIC (Sn)

FD075 spontaneous (*adj.*) **1** Describes natural development taking place without the aid of external forces. **2** Describes the supposed development of living material from non-living matter, *e.g.* the theory of spontaneous generation (abiogenesis); this theory is now of historical interest only. ↓ ECTOGENIC (An) ↑ ENDOGENOUS

FD076 exogenous (*adj.*) **1** Describes energy, activities, and processes, arising from a cause outside an organism or part of an organism, or outside a cell, *e.g.* the production of sweat is an exogenous response to a temperature rise. **2** Developing from surface tissues of an organism or from tissues previously ossified. ↓ ECTOGENIC · ALLOGENIC · ALLOGENOUS ↑ DIURNAL RHYTHM · ENDOGENOUS (An)

FD077 ectogenic (*adj.*) Describes an action or process not caused by an organism itself. ↑ AUTOGENIC (An) · EXOGENOUS

FD078 allogenic (*adj.*) Describes an action or process arising in an organism which is caused by an action, process, or condition, outside the organism. ↑ AUTOGENIC (An) · EXOGENOUS

FD079 allogenous (*adj.*) Produced outside itself, but used by an organism, *e.g.* a vaccine made from bacteria taken from one animal is an allogenous vaccine for any other animal. ↑ AUTOGENOUS (An) · EXOGENOUS

Internal Environment

FE001 internal environment (*n.*) (In animals) the environment of the body cells, *i.e.* the tissue fluid which bathes the cells. The concentration of solutes in the tissue fluid is in equilibrium with the concentration of solutes in the blood, and with the concentration of substances in the cells. The composition of the blood is regulated by various feedback mechanisms, and, in turn, the blood controls the composition of the tissue fluid and hence the internal environment. The concentration of solutes is kept almost constant within narrow limits (homeostasis). ↓ OSMOREGULATION · EXCRETION · PASSIVE TRANSPORT · CONTRACTILE VACUOLE · ABSORPTION[1] · ABSORB[1] · EXCRETORY · UREOTELIC · SWEAT → COELOMODUCT · FUNCTION[2] · TRANSPIRATION · FEEDBACK

FE002 osmoregulation (*n.*) The control of the osmotic pressure of solutes in the intercellular liquids of animals. Control is effected in two ways, ***a*** by the removal of water to increase concentration of solutes and to increase osmotic pressure—this is especially important in animals living in fresh water, ***b*** by the removal of solutes to decrease concentration, the solutes mainly being waste products, and to decrease

osmotic pressure—especially important in marine-dwelling animals. Excretory organs are usually associated with osmoregulation. Most terrestrial animals conserve water in their bodies, and little water is found in their excreta, *e.g.* birds, reptiles. ↓ HOMEOSTASIS · TONUS[1] ↑ INTERNAL ENVIRONMENT → CONTRACTILE VACUOLE · FLAME CELL · NEPHRIDIUM · MALPIGHIAN TUBULE · KIDNEY

FE003 homeostasis (*n.*) The maintenance of a constant internal environment. The factors kept constant include: the osmotic pressure of solutes; the pH and the temperature of the liquid environment; the concentration of individual substances, *e.g.* glucose, anions and cations, dissolved gases. Deviations from these limits have a deleterious effect on cells, with brain cells being most rapidly affected. Both vertebrates and invertebrates can exhibit homeostasis, ***e.g. a*** estuarine crab species are able to osmoregulate and cope with varying degrees of salinity; ***b*** birds and mammals maintain a constant internal environment □ *a mammal* exhibits *homeostasis* ↑ OSMOREGULATION

FE004 tonus[1] (*n.*) **1** (In animals) the condition of being in moderate physiological action, normal for a tissue or organ; it is the result of continuous normal physiological stimulation. **2** (In plants) a condition of healthy response to external conditions. ↑ OSMOREGULATION

FE005 excretion (*n.*) The removal of the end-products of metabolism which have no further use in an organism. The products are either stored in an insoluble form or removed to the exterior. The two main excretory products from animals are the end-products of carbohydrate metabolism (carbon dioxide) and of protein metabolism (nitrogenous waste). Nitrogenous waste is excreted by nephridia in many invertebrates, by Malpighian tubules in insects, and by kidneys in vertebrates. —EXCRETA (*n.*) EXCRETORY, EXCRETIVE (*adj.*) EXCRETE (*v.*) ↓ EXCRETA · WASTE PRODUCTS · NITROGENOUS WASTE ↑ INTERNAL ENVIRONMENT → SECRETION[1]

FE006 excreta (*n.pl.*) The waste material formed during metabolism and removed during excretion, *e.g.* excreta include carbon dioxide, urea, and uric acid. Contrast **faeces** which are substances left after absorption has taken place, and which are egested from the organism, *e.g.* cellulose in human beings is not affected by digestive juices, and is egested from the alimentary canal. ↑ EXCRETION → UREA

FE007 waste products (*n.pl.*) Metabolites which take no further part in metabolism; they include carbon dioxide, urea, and uric acid. When eliminated from the body, they become excreta. ↑ EXCRETION → METABOLITE

FE008 nitrogenous waste (*n.*) During metabolism of animals, the deamination of amino acids produces ammonia, a highly toxic substance. In protozoans, the small quantity of ammonia produced diffuses out of the cell. In metazoans, the ammonia is converted to urea or to uric acid, both of which are less toxic. Various excretory structures eliminate the urea or uric acid from these animals. Urea and uric acid are the main forms of nitrogenous waste; other forms include guanin. ↑ EXCRETION → DEAMINATION

FE009 passive transport (*n.*) The transfer of substances from a region of high concentration to a region of low concentration through a permeable cell membrane; the process takes place by diffusion. The rate of diffusion is governed principally by the lipid solubility and secondarily by the molecular size of the substance. Non-ionic solutes with a high lipid solubility diffuse more quickly than those with a low lipid solubility. Weak electrolytes diffuse more rapidly than strong electrolytes; ionic charge lowers the rate of diffusion. The physiological state of the cell also influences the rate of diffusion, *e.g.* active muscle cells are much more permeable to glucose than resting cells. ↓ ACTIVE TRANSPORT ↑ INTERNAL ENVIRONMENT

FE010 active transport (*n.*) Transfer of dissolved substances across a membrane from a region of low concentration to a region of high concentration. The transfer is made by a carrier which uses up energy in the process. ↑ INTERNAL ENVIRONMENT

FE011 contractile vacuole (*n.*) (In protozoans, especially fresh-water species) a vacuole concerned with osmoregulation and possibly excretion. The membrane surrounding the vacuole permits the vacuole to fill with water from the cytoplasm; the vacuole contracts periodically, expelling the contents to the exterior of the cell. The vacuole liquid may contain excreta to assist the elimination by diffusion. The expansion and contraction of the vacuole are referred to as the **diastole** and **systole** respectively. ↑ INTERNAL ENVIRONMENT

FE012 absorption[1] (*n.*) The process of absorbing. ↓ ABSORPTIVITY · ABSORBENT[1] ↑ INTERNAL ENVIRONMENT

FE013 absorptivity (*n.*) The disposition to absorb; a property of a material or a substance measuring the ability to absorb. ↑ ABSORPTION

FE014 absorbent[1] (*n.*) A material, substance or object used to absorb, *e.g.* sodium hydroxide solution is the best absorbent for carbon dioxide □ *alkaline pyrogallol is an absorbent for oxygen* ↑ ABSORPTION

FE015 absorb[1] (*v.t.*) (Of a plant, tissue, or cell) to take into itself a liquid, solution or a solute from a solution; the solute can be a solid or a gas. The actual mechanism of entry, diffusion or osmosis is not specified, *e.g.* ***a*** root hairs of a plant absorb water from the soil; ***b*** villi in the small intestine absorb digested food in solution. —ABSORPTION, ABSORBENT (*n.*) ABSORBENT, ABSORPTIVE (*adj.*) ↓ EXCRETE (Cn) · TAKE UP[1] ↑ INTERNAL ENVIRONMENT → DIFFUSION · OSMOSIS · SECRETE (Cn)

FE016 excrete (*v.t.*) To eliminate waste products (excreta) from the body of an organism, *e.g.* mammals excrete their nitrogenous waste in urine. ↑ ABSORB[1] · INTERNAL ENVIRONMENT

FE017 take up[1] (*v.t.*) (Of plants) to absorb mineral ions from soil water; to absorb water, *e.g.* plants take up water from the soil. —***uptake*** (*n.*) ↑ ABSORB[1] (Sn)

FE018 excretory (*adj.*) Effecting excretion or to do with excreta, *e.g.* ***a*** the kidney is an excretory organ; ***b*** urea is an excretory product. ↓ EXCRETIVE ↑ INTERNAL ENVIRONMENT

FE019 excretive (*adj.*) Of or to do with the process of excretion, *e.g.* the production of urea from ammonia is an excretive process. ↑ EXCRETORY

FE020 absorbent[2] (*adj.*) Describes a material or substance able to absorb, *e.g.* filter paper is an absorbent material. ↑ EXCRETORY

FE021 absorptive (*adj.*) Describes a material or substance taking part in absorption, *e.g.* the lining of the small intestine is the absorptive surface for glucose and amino acids. ↑ EXCRETORY

FE022 ureotelic (*adj.*) Describes an animal that eliminates nitrogenous waste as urea, *e.g.* elasmobranchs, adult amphibians, turtles and tortoises, mammals. It is the characteristic method of excretion of aquatic oviparous animals, or of viviparous animals. ↓ URICOTELIC · AMMONIOTELIC ↑ INTERNAL ENVIRONMENT

FE023 uricotelic (*adj.*) Describes animals that eliminate nitrogenous waste as uric acid, *e.g.* insects, reptiles and birds. It is the characteristic method of excretion of terrestrial animals that are oviparous. ↑ UREOTELIC → CLEIDOIC

FE024 ammoniotelic (*adj.*) Describes an animal that excretes nitrogenous waste as ammonia, *e.g.* protozoans, many invertebrates, particularly aquatic forms, teleosts and larvae of amphibians. In protozoans and small invertebrates ammonia is eliminated by diffusion. ↑ UREOTELIC

FE025 sweat (*n.*) A liquid excretion, composed of a dilute solution of sodium chloride, with a little urea, and traces of other substances. Its function is to cool the skin by evaporation, and so regulate the body temperature of mammals. It plays a small part in the osmoregulation of the body, the water loss being balanced by urination □ *sweat exudes from sweat pores onto the skin* —***sweaty*** (*adj.*) SWEAT (*v.*) ↓ PERSPIRATION (Sn) · DEATH POINT · VASOMOTION · HOMOIOTHERMIC ↑ INTERNAL ENVIRONMENT

FE026 perspiration (*n.*) **1** The act or process of sweating; the term implies the excretion of a smaller amount of liquid than sweating. **2** The liquid excreted in this way. Alternative term for **sweat**, but implies a much smaller quantity. Not strictly a scientific term —***perspire*** (*v.*) ↓ SWEAT GLAND · SWEAT PORE ↑ SWEAT (Sn)

FE027 sweat gland (*n.*) (In mammals) an elongated, coiled, tubular gland, deep in the dermis, but formed from epidermal tissue; it secretes sweat. Sweat passes up a sweat duct to the exterior. Sweat glands are under the control of the sympathetic nervous system. The number of sweat glands varies over the surface of a mammal, and the total number varies considerably from species to species. ↑ PERSPIRATION

FE028 sweat pore (*n.*) A minute aperture in the epidermis which is the opening of a sweat skin duct to the exterior, allowing sweat to cover the skin □ *sweat exudes from sweat pores* ↑ PERSPIRATION

FE029 death point (*n.*) The temperature above or below which an organism cannot live. ↑ SWEAT

FE030 vasomotion (*n.*) The constriction and dilation of blood-vessels; the action partially controls the quantity of sweat produced. —***vasometer*** (*adj.*) ↓ VASOCONSTRICTION · VASODILATION · VASOMOTOR NERVE · VASOCONSTRICTOR · VASODILATOR ↑ SWEAT → BLOOD VESSEL

FE031 vasoconstriction (*n.*) A narrowing of blood vessels, particularly arterioles, usually in response to a fall in temperature in the surroundings, but also arising from other causes. The constriction is caused by contraction of the smooth muscle in the arteriole walls. —VASOCONSTRICTOR (*n.*) ↓ VASODILATION (Cn) ↑ VASOMOTION → ARTERIOLE

FE032 vasodilation (*n.*) An expansion of blood vessels, especially arterioles, usually in response to a rise in temperature in the surroundings. The dilation arises from relaxation of the smooth muscle in the arteriole walls. —VASODILATOR (*n.*) ↑ VASOMOTION · VASOCONSTRICTION (Cn) → ARTERIOLE

FE033 vasomotor nerve (*n.*) (In vertebrates) a nerve of the sympathetic nervous system; it regulates the diameter of blood vessels, particularly arteries and arterioles. The change in diameter occurs in response to temperature changes in the surroundings. A vasomotor nerve possesses nerve fibres for vasoconstriction and vasodilation. ↑ VASOMOTION → SYMPATHETIC NERVOUS SYSTEM

FE034 vasoconstrictor (*n.*) A nerve or a chemical substance causing vasoconstriction. ↑ VASOMOTION → VASOPRESSIN

FE035 vasodilator (*n.*) A nerve or a chemical substance causing vasodilation. ↑ VASOMOTION

FE036 homoiothermic (*adj.*) Describes an animal with a constant body temperature, usually above that of the surrounding medium, *e.g.* birds and mammals. **Warm blooded** is often wrongly used instead of homoiothermic. ↓ POIKILOTHERMIC (I) · HOMOIOTHERMAL · POIKILOTHERMAL ↑ SWEAT

FE037 poikilothermic (*adj.*) Describes an animal with a body temperature varying with that of the surroundings. Aquatic animals have a body temperature very close to that of the surrounding water. Terrestrial animals have a body temperature which

may differ considerably from that of the surrounding air owing to heating by radiation from the sun or to heat from muscular effort, or owing to cooling by evaporation. All animals, except birds and mammals, are poikilothermic. **Cold-blooded** is often wrongly used instead of poikilothermic. ↑ HOMOIOTHERMIC (I)

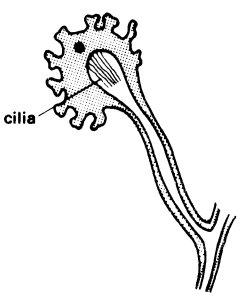
FE038 homoiothermal (*adj.*) Alternative term for HOMOIOTHERMIC.

FE039 poikilothermal (*adj.*) Alternative term for POIKILOTHERMIC.

Excretion

FF001 coelomoduct (*n.*) A channel formed from the mesodermal lining of the coelom; it connects the coelom with the exterior. Its function can be either to conduct gametes from gonads to the exterior, or to conduct excreta to the exterior, as in the nephridia of molluscs and annelids. ↓ PROTONEPHRIDIUM · NEPHRIDIUM · MALPIGHIAN TUBULE · UROCOEL · KIDNEY · NEPHRON · URINE → INTERNAL ENVIRONMENT · COELOM

FF002 protonephridium (*n., pl.* **protonephridia**) A system of excretory ducts, canals and tubules leading from openings to the exterior, anastomosing over the body of the animal, ending in flame cells. Planarians and cestodes have two main excretory ducts, one on each side of the body; canals branch from these, become tubules, and end in flame cells. ↓ FLAME CELL · SOLENOCYTE · GREEN GLAND ↑ COELOMODUCT



FLAME CELL

FF003 flame cell (*n.*) A club-shaped, tubular, hollow cell with numerous processes; a tuft of cilia arises from the bulbous end, inside the lumen of the cell. The cell lumen connects with an excretory tubule. Water and nitrogenous waste diffuse into the cell, pass through to the lumen, where the cilia flicker continuously (giving the cell its name) and drive a current of liquid into the excretory tubule. Excretory tubules form a protonephridium. Flame cells are found in platyhelminthes. ↓ SOLENOCYTE (Sn) ↑ PROTONEPHRIDIUM

FF004 solenocyte (*n.*) A cell of similar structure to a flame cell, but with flagella arising from the bulbous end, inside the lumen. The function of a solenocyte is the same as that of a flame cell; they are connected to nephridia. Solenocytes are found in some Polychaeta and in *Amphioxus*. ↑ PROTONEPHRIDIUM · FLAME CELL (Sn)

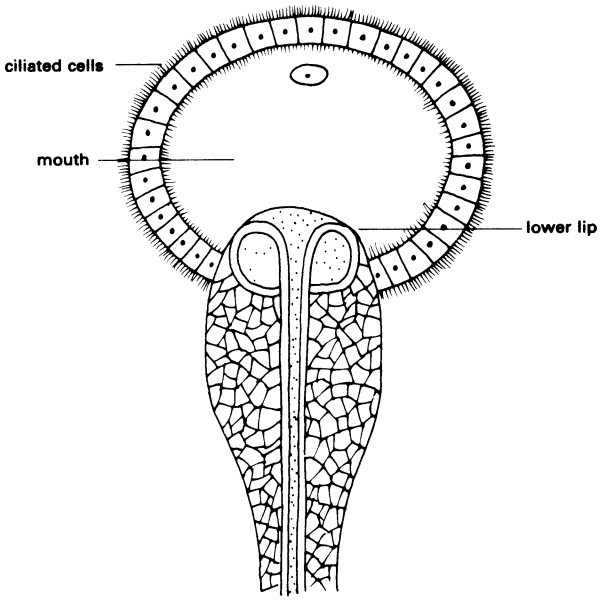
FF005 green gland (*n.*) One of two glands in some crustaceans; it functions as an excretory organ. ↑ PROTONEPHRIDIUM

FF006 nephridium (*n., pl.* **nephridia**) (In annelids) an excretory organ consisting of a nephrostome, a glandular portion and a bladder, opening into a nephridiopore. The glandular portion is intracellular, *i.e.* it consists of a tube running through interconnected cells; it is much convoluted, and its loops are surrounded by a network of capillaries. The nephrostome is in one segment of the worm, and the remaining parts of the nephridium are in the succeeding segment. Coelomic fluid, containing nitrogenous waste, is drawn into the nephrostome; in the glandular portion, osmoregulation takes place with reabsorption from the nephridium into the blood in the capillaries. The final liquid product is passed from the bladder by muscular contraction, out through the nephridiopore. —***nephridial*** (*adj.*) ↓ NEPHROSTOME · CHLORAGEN CELL · NEPHRIDIOPORE · METANEPHRIDIUM · CHLORAGEN CELL ↑ COELOMODUCT

FF007 nephrostome (*n.*) A tube, the nephrostome funnel, ends in a spoon-shaped mouth with a lower lip, surrounded on the sides and above by ciliated cells. A nephrostome is situated in the coelom of a segment; all segments of an annelid, except the first three and the last one, possess a pair of nephrostomes. Beating of the cilia forms a current, driving coelomic fluid down the nephrostome funnel. ↑ NEPHRIDIUM

FF008 chloragen cell (*n.*) (In annelids) a yellow cell, found on the wall of the intestine (the walls are covered with such cells); it collects excretory products. Chloragen cells migrate to the coelom where they are digested by amoebocytes. The amoebocytes give up their excretory products at nephrostomes; they are too big to enter a nephrostome. ↑ NEPHRIDIUM → AMOEBOCYTE

FF009 nephridiopore (*n.*) The opening to the exterior of the long tube of a nephridium. The bladder part of the nephridium is intracellular, with smooth muscle enclosing the tube, expelling the excreta through the nephridiopore. ↑ NEPHRIDIUM



NEPHROSTOME

FF010 metanephridium (*n.*, *pl.* **metanephridia**) Alternative term for NEPHRIDIUM (↑). ↑ COELOMODUCT

FF011 chloragogen cell (*n.*) Alternative term for CHLORAGEN CELL (↑).

FF012 Malpighian tubule (*n.*) (In all arthropods except crustaceans) one of a number of thread-like tubes leading from the anterior part of the hind-gut and ending in the haemocoel. Each tubule is lined with glandular epithelium; it absorbs water, mineral ions, and nitrogenous waste (as salts of uric acid), from the blood. Water is reabsorbed in the rectum, together with other substances important for osmoregulation. The Malpighian tubules are concerned with maintaining constant conditions in the internal environment and with the excretion of uric acid. ↓ FAT-BODY · CORPUS ADIPOSUM ↑ COELOMODUCT

FF013 fat-body (*n.*) **1** (In insects) a tissue of indeterminate form, distributed beneath the skin and around the gut, storing fat, protein, and sometimes uric acid, so acting as an excretory organ. The uric acid has a possible use in the formation of chitin for the exoskeleton. The fat is an important food reserve during periods of inactivity, such as diapause. **2** (In amphibans and lizards) an organ containing vascularized tissue structures filled with fat globules, providing a food reserve for hibernation. ↑ MALPIGHIAN TUBULE → CHITIN

FF014 corpus adiposum (*n.*) Alternative term for FAT-BODY.

FF015 urocoel (*n.*) (In molluscs) a cavity, part of the reduced coelom, containing a nephridium. ↓ NEPHROMIXIUM

FF016 nephromixium (*n.*) An excretory organ combining both flame cells and nephrostomes connected to a protonephridium. ↑ UROCOEL

FF017 kidney (*n.*) (In vertebrates) an organ concerned with, ***a*** osmoregulation; ***b*** the elimination of nitrogenous waste. Kidneys of different species of vertebrates vary in structure, according to the animal's mode of life, but the basic structure, and function, is similar in all cases. A kidney comprises numerous nephrons and their associated blood supply; it consists of two zones, cortex and medulla, encased in a fatty protective capsule. ↓ HILUM[2] · UROGENITAL SYSTEM · URETER · NEPHRITIS · RENAL · NEPHRON ↑ COELOMODUCT

FF018 hilum[2] (*n.*) A concavity on the inner border of a kidney. ↓ CORTEX[2] · MEDULLA[2] · PYRAMID · PAPILLA[2] · PELVIS[2] · RENICULUS ↑ KIDNEY

FF019 cortex[2] (*n.*) The outer, dark-red region of a kidney; in it are situated the Malpighian corpuscles and the two convoluted portions of the uriniferous tubules. The cortex extends right round the kidney, except at the hilum. ↑ HILUM[2] → CORTEX[1]

FF020 medulla[2] (*n.*) The inner, paler-coloured region of a kidney, surrounded by the cortex; in it are situated the collecting tubules leading from the uriniferous tubules to the pyramid. ↓ PYRAMID ↑ HILUM[2] → MEDULLA[1]

FF021 pyramid (*n.*) A projection of the medulla into the pelvis. The collecting tubules join up to form ducts with small openings in the apex of the pyramid. The base of the pyramid rests on the cortex. ↑ HILUM[2] · CORTEX[2] · MEDULLA[2]

FF022 papilla[2] (*n., pl.* **papillae**) The apex of a pyramid in the medulla. The ducts from the collecting tubules open into the papillae, and the openings are called papillary ducts. —***papillary*** (*adj.*) ↑ HILUM[2]

FF023 pelvis[2] (*n.*) A small cavity formed by the ureter swelling out where it connects to the kidney. It collects urine from the papillary ducts. ↑ HILUM[2]

FF024 reniculus (*n.*) The lobe of a kidney consisting of papillae, pyramid, and the supporting part of the cortex. ↑ HILUM[2]

FF025 urogenital system (*n.*) In vertebrates, the excretory and reproductive systems are closely linked; when both systems are considered together, the whole system is called the urogenital system. ↓ URINOGENITAL SYSTEM · URINARY TRACT ↑ KIDNEY

FF026 urinogenital system (*n.*) Alternative term for UROGENITAL SYSTEM.

FF027 urinary tract (*n.*) The system of tubules, ducts, and tubes, from the uriniferous tubules to the urethra, concerned with the production and conduction of urine. ↑ UROGENITAL SYSTEM

FF028 ureter (*n.*) (In amniotes) a tube for conducting urine away from a kidney. There are two ureters, one leading from each kidney. In anamniotes, urine is conducted away from a kidney by a Wolffian duct. ↓ URINARY BLADDER · URETHRA ↑ KIDNEY → WOLFFIAN DUCT

FF029 urinary bladder (*n.*) A sac for storing urine. In fishes it is an expansion of the Wolffian duct; in amphibians and mammals it is a diverticulum of the hind-gut; it is absent in birds and most reptiles. Urine is conducted to the bladder by a ureter or a Wolffian duct. The exit to the bladder is closed by a sphincter muscle. ↑ URETER → WOLFFIAN DUCT

FF030 urethra (*n.*) (In mammals) a tube leading from the urinary bladder to the exterior. In females it is short, leading into the vestibule. In males it is longer, leading through the penis; it is joined by the vas deferens, and serves to conduct both urine and sperms. ↑ URETER → VAS DEFERENS

FF031 nephritis (*n.*) Inflammation of a kidney. ↑ KIDNEY

FF032 renal (*adj.*) Of or to do with a kidney, particularly the kidney as a structural organ, *e.g.* the renal artery is the artery supplying a kidney. ↓ URINOGENITAL ↑ KIDNEY

FF033 urinogenital (*adj.*) Of or to do with both the urinary and the reproductive systems. ↑ RENAL

FF034 nephron (*n.*) The structural and functional unit of a vertebrate kidney; it consists of a Malpighian corpuscle and a uriniferous tubule. There are about 1 million nephrons in one human kidney. ↓ NEPHROS · PRONEPHROS · MALPIGHIAN CORPUSCLE · NEPHRITIC ↑ COELOMODUCT

FF035 nephros (*n.,pl.* **nephroi**) The functional part of a kidney —NEPHRITIC, NEPHRIC (*adj.*) ↓ PRONEPHROS · MESONEPHROS · METANEPHROS ↑ NEPHRON

FF036 pronephros (*n., pl.* **pronephroi**) (In vertebrates) the first development of a kidney in an embryo. It appears as a number of nephrons, situated one in each somite. Each nephron communicates with the coelom by a pronephric duct (a coelomoduct); the latter leads to the exterior. In the larvae of anamniotes, it is the functional kidney; in adult anamniotes, it is small and without function; in amniotes, it is vestigial. The pronephric duct develops into the Wolffian duct. —***pronephric*** (*adj.*) ↑ NEPHROS → AMNIOTE · WOLFFIAN DUCT

FF037 mesonephros (*n., pl.* **mesonephroi**) (In vertebrates) an embryonic development of a kidney later than, and posterior to, the pronephros; there is one mesonephros on each side of the body. The testes, in males, become connected with the mesonephros; a joint duct, the Wolffian duct, developed from the pronephric duct, conducts excretory products and sperms to the exterior. In anamniotes, the mesonephroi become the functional kidneys; in amniotes, they function as kidneys in the earlier stages of the embryo, but in the later stages, and in the adult, they degenerate, except for, in males, the part concerned with the conduction of sperms. —***mesonephric*** (*adj.*) ↑ NEPHROS → WOLFFIAN DUCT

FF038 metanephros (*n., pl.* **metanephroi**) (In amniotes) an organ arising in embryonic development later than the mesonephros; it is situated posterior to a mesonephros, and replaces the mesonephros as a functional kidney in the later stages of the embryo and in the adult. A duct, the ureter, is developed from the pronephric duct. —***metanephric*** (*adj.*) ↑ NEPHROS

FF039 Malpighian corpuscle (*n.*) A corpuscle consisting of a Bowman's capsule and its glomerulus; its function is to filter non-colloidal solutes and water out of the blood. ↓ BOWMAN'S CAPSULE · GLOMERULUS · URINFEROUS TUBULE · LOOP OF HENLE · HENLE'S LOOP · MALPIGHIAN BODY ↑ NEPHRON

FF040 Bowman's capsule (*n.*) A small sac, formed from a double wall of epithelial cells, one-cell thick; it is an outgrowth from the end of a tubule, has the shape of a cup, with a narrow opening, and the space between the two walls drains into the tubule. It is situated in the cortex of a kidney. Its function is filtration, and it produces a filtrate about the same composition as blood plasma without the colloidal solutes. ↑ MALPIGHIAN CORPUSCLE

FF041 glomerulus (*n., pl.* **glomeruli**) A knot of capillaries situated inside a Bowman's capsule; blood is supplied by an afferent arteriole, and leaves by an efferent arteriole. Blood is supplied in all vertebrates by renal arteries. In fishes and

amphibians the efferent arteriole supplies blood to a capillary network covering the uriniferous tubule, and the renal portal vein adds blood to this supply. In reptiles, birds, and mammals, the capillary network is supplied by the efferent arteriole only. Most of the solutes, except for colloidal solutes, and much of the water in blood, are filtered out of the glomerulus by the Bowman's capsule, and enter the uriniferous tubule. —GLOMERULAR (*adj.*) ↑ MALPIGHIAN CORPUSCLE

FF042 uriniferous tubule (*n.*) A narrow, coiled, and much convoluted tube, in which urine is produced from the filtrate by reabsorption and excretion. In vertebrates other than mammals, the tubule is entirely surrounded by a network of capillaries. The function of the tubule is, ***a*** to transfer water and dissolved solutes, such as glucose, back to the blood (reabsorption); ***b*** to transfer substances from the blood to the tubule (excretion). The final product is urine. In mammals, the uriniferous tubule consists of three parts, ***a*** the proximal convoluted tubule; ***b*** the loop of Henle; ***c*** the distal convoluted tubule. In the convoluted tubules, substances from the blood are transferred by active transport and by excretion. ↑ MALPIGHIAN CORPUSCLE

FF043 loop of Henle (*n.*) A loop of a uriniferous tubule; it descends into the medulla of a kidney (the two convoluted portions are in the cortex) and is enclosed in a network of capillaries. Reabsorption of water and solutes from the tubule into the blood takes place in the loop. ↑ MALPIGHIAN CORPUSCLE

FF044 Henle's loop (*n.*) Alternative term for LOOP OF HENLE.

FF045 Malpighian body (*n.*) Alternative term for MALPIGHIAN CORPUSCLE (↑).

FF046 nephritic (*adj.*) Of or to do with a kidney, particularly the functional part or the function of a kidney. ↓ NEPHRIC

FF047 nephric (*adj.*) Alternative term for NEPHRITIC.

FF048 urine (*n.*) In ureotelic animals, a liquid excretion from the kidneys; in uricotelic animals, a solid, or semi-solid, excretion from the kidneys of reptiles and birds, and from the Malpighian tubules of insects. Human urine contains on average 2% urea and 1% sodium chloride but the concentration can vary depending upon diet, external conditions, and other factors. Other substances are also in solution in lower concentrations. The normal output of human urine is about 1500 cm^3 per day. —URINATION (*n.*) URINARY, URINIFEROUS (*adj.*) ***urinate*** (*v.*) ↓ URINATION · UROCHROME · UROBILIN · UROSCOPY · URINARY ↑ COELOMODUCT

FF049 urination (*n.*) The act of emptying the urinary bladder. ↓ MICTURATION ↑ URINE

FF050 micturation (*n.*) Alternative term for URINATION

FF051 urochrome (*n.*) The yellow-colouring substance in liquid urine; it consists of urobilin and amino acids. ↓ UROBILIN · UROBILINOGEN ↑ URINE

FF052 urobilin (*n.*) A brown pigment in urine, normally present only in small amounts. ↑ UROCHROME

FF053 urobilinogen (*n.*) A colourless compound derived from bilirubin; on oxidation in the presence of acids it forms urobilin. ↑ UROCHROME → BILIRUBIN

FF054 uroscopy (*n.*) The examination of urine to identify pathological conditions, *i.e.* diseases, etc., in a person or other animal. ↓ ALBUMINURIA ↑ URINE

FF055 albuminuria (*n.*) A condition in which albumin is present in urine. ↑ UROSCOPY → ALBUMIN · ALBUMINOSIS

FF056 urinary (*adj.*) Of or to do with urine, especially describing a structure or organ associated with urine, *e.g.* ureters are urinary ducts, as they conduct urine. ↓ URINIFEROUS ↑ URINE

FF057 uriniferous (*adj.*) To do with the production of urine, *e.g.* a uriniferous tubule produces urine. ↑ URINARY

Function

FG001 function[2] (*n.*) The way in which any part of an organism helps in the life processes, (such as digestion, metabolism, reproduction or respiration) of that organism. The function of a part describes the processes taking place, or the way it carries out its work, *e.g.* ***a*** one function of the stomach wall is the secretion of pepsin; ***b*** the function of the epiglottis is to prevent food entering the trachea; ***c*** the function of the vocal cords is to produce sound. —FUNCTION (*v.*) FUNCTIONAL (*adj.*) ↓ SYNERGISM · ABSCISSION · DECAY[1] · MECHANISM[2] · PHYSIOLOGY · MALFUNCTION · FUNCTIONAL · BENEFICIAL · ELABORATORY → INTERNAL ENVIRONMENT

FG002 synergism (*n.*) The condition of two substances or two structures mutually helping each other, especially when the united effort of two substances produces an effect greater than the sum of their individual efforts. —SYNERGIST (*n.*) SYNERGIC (*adj.*) ↓ ANTAGONISM (Cn) · RHYTHM · ANTIBIOSIS[1] · COORDINATION · HARMONY[1] · DISHARMONY · HYPOFUNCTION · HYPERFUNCTION ↑ FUNCTION[2]

FG003 antagonism (*n.*) The mutual action between two substances, structures or

organisms, when the two are in opposition, *e.g.* ***a*** antagonism between two muscles; ***b*** antagonism between toxin and antitoxin; ***c*** antagonism between two animals fighting for the same territory. —ANTAGONIST (*n.*) ↑ SYNERGISM (Cn)

FG004 rhythm (*n.*) A regularity in movement; a process or a series of occurrences, *e.g.* ***a*** the beating of the heart follows a particular rhythm; ***b*** the life cycle of an annual herb follows a rhythm; ***c*** seasonal variation in many organisms is rhythmic □ *the leg movements of quadrupeds follows a particular rhythm* —***rhythmic*** (*adj.*) ↑ SYNERGISM

FG005 antibiosis[1] (*n.*) The phenomenon of antagonism between micro-organisms, including fungi, caused by the production of toxic substances (antibiotics). ↑ SYNERGISM · ANTAGONISM → ANTIBIOTIC

FG006 coordination (*n.*) The control of all body functions in animals, *e.g.* in birds, the vascular system cannot increase the supply of blood to the alimentary canal for absorption purposes when the muscles require an increased blood supply for rapid flight; the two requirements must be controlled to promote the more important one and to inhibit the less important one. Such coordination is effected by neural and chemical mechanisms, working in harmony. The chemical mechanism uses hormones, which act mainly in a slower manner than the neural mechanisms. Metabolism, growth, and sexual activities, are controlled mainly by hormones □ *coordination is effected by the sympathetic nervous system, i.e. coordination is achieved* —***coordinate*** (*v.*) ↑ SYNERGISM → HORMONE

FG007 harmony[1] (*n.*) Agreement in action, *e.g.* when flexor muscles contract, extensor muscles relax; their actions are in harmony. If both muscles contracted, their action would be in disharmony □ *the two functions act in harmony; two actions are either in harmony or out of harmony* —***harmonize*** (*v.*) ↓ DISHARMONY (Cn) ↑ SYNERGISM

FG008 disharmony (*n.*) Disagreement in action. ↑ SYNERGISM · HARMONY[1] (Cn)

FG009 hypofunction (*n.*) A condition in which an organ or a gland is not fully performing its functions; the term usually implies a deficiency of a secretion. The condition may be caused by atrophy or disease. ↓ HYPERFUNCTION (Cn) ↑ SYNERGISM

FG010 hyperfunction (*n.*) A condition in which an organ or a gland is functioning in excess of normal requirements; the term usually implies an excess of a secretion. The condition may be caused by hypertrophy, hyperplasia, or disease. ↑ SYNERGISM → HYPERPLASIA

FG011 abscission (*n.*) A natural process by which two parts of an organism become separated, *e.g.* a spore from a sporophore, a leaf from a stem. ↓ TENSION[2] · TOLERANCE · EXCITATION ↑ FUNCTION[2]

FG012 tension[2] (*n.*) A negative pressure, *e.g.* if two ends of a rod are pushed together, the material is under pressure; if the two ends are pulled, the material is under tension. ↑ ABSCISSION

FG013 tolerance (*n.*) (Of an organism) the ability to survive under conditions which may be adverse for other organisms, or may become adverse for the particular organism, *e.g.* ***a*** citrus fruits exhibit tolerance towards acidic soils; ***b*** certain plants exhibit tolerance towards saline soils. ↑ ABSCISSION

FG014 excitation (*n.*) The causing or act of producing or increasing stimulation; the immediate response of a tissue or living cell to a stimulus or change in the environment, *e.g.* the excitation of voluntary muscle is produced by the end-plates of the motor nerves. —***excite*** (*v.*) EXCITATORY, ***excited*** (*adj.*) ↑ ABSCISSION → EXCITABILITY

FG015 decay[1] (*n.*) The biochemical decomposition of dead plant or animal material resulting from the feeding activities of bacteria and fungi. —***decay*** (*v.*) ***decaying*** (*adj.*) ↑ FUNCTION[2]

FG016 mechanism[2] (*n.*) The action or process, by which a function is performed or an effect is produced, *e.g.* ***a*** the clotting of blood consists of a series of enzymolytic actions (the mechanism is the way in which this function is performed); ***b*** the mechanism controlling plant growth consists of processes controlled by phytohormones; ***c*** the mechanism for dark adaptation of compound eyes uses the migration of pigments in ommatidia. —***mechanistic*** (*adj.*) ↓ ELABORATION[2] · PRECURSOR · EXCITABILITY · BIOSYNTHESIS · PRIMORDIUM ↑ FUNCTION[2]

FG017 elaboration[2] (*n.*) The process of elaborating complex chemical compounds. ↑ MECHANISM[2] → ELABORATE[2]

FG018 precursor (*n.*) A compound formed before a final product, from which the final product is derived, *e.g.* prothrombin is changed to thrombin by thrombokinase; prothrombin is the precursor of thrombin. ↑ MECHANISM[2]

FG019 excitability (*n.*) The disposition of a tissue or a living cell to respond to a stimulus or to a change in the environment, *i.e.* the disposition to excitation. —EXCITABLE (*adj.*) ↑ MECHANISM[2] · EXCITATION

FG020 biosynthesis (*n.*) The production of chemical compounds by living organisms from elements or from simpler substances, *e.g.* the biosynthesis of starch in plants from carbon dioxide and water. —***biosynthesize*** (*v.*) ***biosynthetic*** (*adj.*) ↑ MECHANISM[2]

FG021 primordium (*n.,pl.* **primordia**) A structure at the time when it first indicates clearly what it will become, *e.g.* structures when first identifiable as leaves are called leaf primordia. —***primordial*** (*adj.*) ↑ MECHANISM[2] → PRIMITIVE

FG022 physiology (*n.*) The study of the functions of structures and the biochemical processes taking place in the structures and in the organism as a whole. ↓ BIOLUMINESCENCE ↑ FUNCTION[2]

FG023 bioluminescence (*n.*) The production of light by certain animals and plants, *e.g.* the firefly produces a green-coloured light. Such light is produced, without heat, in structures called photophores. ↑ PHYSIOLOGY

FG024 malfunction (*v.i.*) To function incorrectly or inadequately, *e.g.* ***a*** insufficient insulin is secreted if the pancreas malfunctions; ***b*** diabetes mellitus is caused by malfunctioning of the Langerhans islets. ↓ IMPAIR[2] · UPSET · ROT[2] · ARREST · DISCOURAGE · TOLERATE · THRIVE · HINDER ↑ FUNCTION[2] → DIABETES MELLITUS · ISLETS OF LANGERHANS

FG025 impair[2] (*v.t.*) When an organ or a structure does not function properly, its purpose is impaired, *i.e.* its usefulness is reduced, *e.g.* ***a*** loss of elasticity of the crystalline lens in an eye (malfunction of the lens) impairs vision (vision is reduced); ***b*** when a knee is damaged, the ability to walk is impaired (malfunction of the knee reduces the ability to walk.) ↑ MALFUNCTION

FG026 upset (*v.t.*) To interfere with a process so that, although it still proceeds, it does not proceed correctly, *e.g.* a lack of vitamin C upsets the formation of collagen fibres (the process is altered and, although the fibres are formed, they are not formed properly). The term refers to the process rather than the function of the formation of the collagen fibres. ↑ MALFUNCTION → INTERFERE (Sn)

FG027 rot[2] (*v.i.*) (Of plant or animal remains) to decay. —***rotten*** (*adj.*)

FG028 arrest (*v.t.*) To slow down and bring to a stop. ↑ MALFUNCTION

FG029 discourage (*v.t.*) To tend to inhibit an action or process, *e.g.* ***a*** lack of sunlight discourages plant growth (it does not stop growth, but it is more difficult for the plant to grow, and growth is slow); ***b*** hairs or trichomes on leaves discourage animals from eating the leaves (the hairs or trichomes on leaves tend to prevent animals eating the leaves, although the animals could eat them if they wished to do so). ↑ MALFUNCTION

FG030 tolerate (*v.t.*) To live under particular conditions; the conditions may not be beneficial or definitely adverse but may have the disposition to become adverse. The conditions are also not definitely adverse, *e.g.* the rhizomes of some water lilies grow anaerobically and tolerate the ethanol so produced. ↑ MALFUNCTION

FG031 thrive (*v.i.*) **(throve, thrived)** To grow vigorously; the term implies beneficial conditions for growth *e.g.* ***a*** cacti can thrive in regions with low rainfall; ***b*** the apple trees are thriving this year (the conditions for the trees must have been advantageous). ↑ MALFUNCTION

FG032 hinder (*v.t.*) To delay or to slow down a process such as growth or movement, *e.g.* contraction of arterioles hinders the passage of blood. —***hindrance*** (*n.*) ↑ MALFUNCTION

FG033 elaborate[2] (*v.t.*) To form complex chemical compounds starting with simpler compounds available in a cell, *e.g.* thyroxin is a complex chemical compound elaborated from simpler chemical compounds and iodine ions made available in the secretory cells of the thyroid gland. —***elaboration*** (*n.*) —ELABORATORY (*adj.*) ↓ MEDIATE ↑ FUNCTION[2]

FG034 mediate (*v.t.*) To act as an intermediate agent between two processes or two functions; the term is mainly used in connection with the transmission of nervous impulses, *e.g.* a synapse mediates activation of one neuron from another. ↑ ELABORATE[2]

FG035 functional (*adj.*) Having a function, *e.g.* ***a*** the third eyelid is functional in birds, but is usually not functional in mammals (in mammals it has no purpose); ***b*** the vermiform appendix of man is not functional (it has no function in digestion). ↓ SYNERGIC · PHYSIOLOGICAL · SYNERGETIC ↑ FUNCTION[2]

FG036 synergic (*adj.*) Describes structures or substances operating together for a particular function, *e.g.* ***a*** the synergic system of muscles and nerves which effect one particular muscular movement, such as bending the elbow; ***b*** certain drugs or hormones which operate separately to influence a process in the same direction have a synergic action; the effect produced by both is greater than the sum of each substance acting alone. ↑ FUNCTIONAL

FG037 physiological (*adj.*) Of or to do with the biochemical processes taking place in an organism, *e.g.* ***a*** the physiological processes by which a nerve conducts an impulse; ***b*** physiological zero is the lowest temperature at which organisms carry out metabolic processes. ↑ FUNCTIONAL

FG038 synergetic (*adj.*) Alternative term for SYNERGIC (↑).

FG039 beneficial (*adj.*) Describes conditions, circumstances, or characteristics, which are helpful, in that they encourage growth or reproduction. ↓ ADVERSE (An) TOLERABLE · FAVOURABLE · ECCRITIC · ADVANTAGEOUS · HARSH ↑ FUNCTION[2]

FG040 adverse (*adj.*) Describes conditions or circumstances which are unfavourable to an organism and inhibit its growth or reproduction. —***adversity*** (*n.*) ↑ BENEFICIAL (An)

FG041 tolerable (*adj.*) Describes conditions that can be tolerated, *e.g.* the salinity of the sea is tolerable to marine animals. ↑ BENEFICIAL

FG042 favourable (*adj.*) Describes conditions or circumstances that are suitable for an organism to grow or develop in, *e.g.* favourable conditions for bacterial growth include a certain degree of humidity and a certain range of temperature. Contrast **beneficial** conditions, which provide actual help for growth, *e.g.* fertilizers are beneficial to plant growth; a high light intensity is favourable to plant growth. ↑ BENEFICIAL

FG043 eccritic (*adj.*) Describes conditions that are preferred by an animal when there

is a choice, *e.g.* if there is a range of temperatures, the eccritic temperature is the one sought by an animal, and the animal will move to the region of that temperature. ↑ BENEFICIAL

FG044 advantageous (*adj.*) Describes conditions which give a particular organism a greater chance of growth or reproduction than other organisms, or a greater chance of living than under normal conditions, *e.g.* the change in climate from being hot and humid to cold and drier was advantageous to the early forms of mammals, so they had a greater chance of growth and reproduction, while the giant reptiles suffered adverse conditions. —***advantage*** (*n.*) ↑ BENEFICIAL

FG045 harsh (*adj.*) Describes conditions under which an organism has difficulties in continuing to live. The conditions hinder growth but are not adverse, and so do not discourage growth, *e.g.* ***a*** severe cold provides harsh conditions for mesophytes, but such conditions are advantageous for cryophytes; ***b*** drought hinders the growth of herbs and provides harsh conditions; if the drought is severe the conditions become adverse. —***harshness*** (*n.*) ↑ BENEFICIAL · FAVOURABLE (Ag) · ADVERSE (Sn)

FG046 elaboratory (*adj.*) Describes tissues or cells which elaborate chemical compounds. ↓ EXCITATORY · EXCITABLE ↑ FUNCTION[2].

FG047 excitatory (*adj.*) Describes an agent of excitation, *e.g.* ***a*** the end-plates of motor nerves are excitatory end-organs for muscles; ***b*** excitatory cells in the sympathetic nervous system are motor cells. ↑ ELABORATORY · EXCITATION

FG048 excitable (*adj.*) Describes a tissue or living cell with the disposition to excitability, *e.g.* chemoreceptors are excitable and respond to the stimulus of chemical substances. ↑ ELABORATORY · EXCITABILITY

Soil Transpiration

FH001 transpiration (*n.*) The loss of water vapour from plants through stomata and, to a much lesser extent, through the cuticle of leaves. The stomata are closed at night and open during the day when most transpiration takes place. Transpiration is responsible for turgor and for translocation of metabolites in plants. ↓ TRANSPIRATION STREAM · ESSENTIAL ELEMENTS · MINERALIZATION · POTOMETER · TAKE UP[2] · EURYHALINE · EARTH · SOIL PROFILE · SOIL SOLUTION → INTERNAL ENVIRONMENT

FH002 transpiration stream (*n.*) The passage of water from the root, up the stem, and out through the leaves; it results from water loss by transpiration. The mechanism of the process involves diffusion pressure deficit (DPD), transpiration pull, and root pressure. Root pressure assists transpiration pull; the transpiration pull increases the DPD of root cells, and this increases the rate of water absorption by the root. ↓ DIFFUSION PRESSURE DEFICIT · TRANSPIRATION PULL · ROOT PRESSURE · COHESION THEORY · GUTTATION · DPD ↑ TRANSPIRATION

FH003 diffusion pressure deficit (*n.*) A measure of the tendency of a plant cell to take up water; it is equal to the net osmotic pressure of the cell sap minus the turgor pressure. The net osmotic pressure of the sap is the difference between the osmotic pressure of the vacuole solution (P_2) and the osmotic pressure of the solution outside the cell (P_1). If T is the turgor pressure then,

$$DPD = (P_2 - P_1) - T$$

If DPD = 0, then $T = (P_2 - P_1)$, the maximum turgor pressure. ↑ TRANSPIRATION STREAM → TURGOR

FH004 transpiration pull (*n.*) The DPD of cells in transpiring leaves (vacuole solution becomes more concentrated) causes withdrawal of water from xylem vessels. This puts the water in xylem vessels under tension. The upward force from this tension, through the cohesion of water molecules, causes transpiration pull, *i.e.* the force keeping water moving up xylem vessels. ↑ TRANSPIRATION STREAM → COHESION

FH005 root pressure (*n.*) A phenomenon depending on osmotic pressure. The sap in a root has a higher osmotic pressure than that of soil water, owing to active transport causing accumulation of ions in the cell sap; the osmotic pressure of the sap can be maintained for long periods of time when the stem of a plant is cut off. The root pressure is the pressure caused by osmosis and it passes water from living root cells into xylem vessels. ↑ TRANSPIRATION STREAM

FH006 cohesion theory (*n.*) The strength of a water column depends upon cohesion between water molecules and adhesion of the water molecules to the walls of xylem vessels. It is a mechanical process, and the water column must be able to withstand the tension of the transpiration pull (the same way as a rope withstands the tension caused by a heavy object). ↑ TRANSPIRATION STREAM

FH007 guttation (*n.*) The secretion of water in drops from a hydathode. ↑ TRANSPIRATION STREAM → HYDATHODE

FH008 DPD (*abbr.*) Abbreviation for **diffusion pressure deficit** (↑). ↑ TRANSPIRATION STREAM

FH009 essential elements (*n.pl.*) The elements essential for holophytic plant nutrition, required in measurable amounts, are calcium, magnesium, and potassium cations, and the following anions: sulphate for sulphur, phosphate for phosphorus, nitrate for nitrogen. Carbon, hydrogen and oxygen are also essential. Oxygen is

obtained from air and water, hydrogen from water, and carbon from carbon dioxide in the atmosphere. ↓ TRACE ELEMENTS · MACRONUTRIENTS · MICRONUTRIENTS ↑ TRANSPIRATION → HOLOPHYTIC

FH010 trace elements (*n.pl.*) These elements are also necessary for holophytic plant nutrition, but are only required in very small amounts, *i.e.* a trace. They are iron (III), manganese, zinc and copper cations, and the following anions: tetraborate for boron, and molybdate for molybdenum. ↑ ESSENTIAL ELEMENTS

FH011 macronutrients (*n.pl.*) Alternative term for ESSENTIAL ELEMENTS (↑).

FH012 micronutrients (*n.pl.*) Alternative term for TRACE ELEMENTS (↑). ↑ ESSENTIAL ELEMENTS

FH013 mineralization (*n.*) The breakdown of complex organic substances by microorganisms to form finally soluble mineral salts, *e.g.* nitrogenous organic compounds are deaminated to form ammonia which in turn is transformed to nitrite and then to nitrate ions. ↓ ACCUMULATION · SELECTIVITY² ↑ TRANSPIRATION

FH014 accumulation (*n.*) The concentration of mineral ions in root cell sap is considerably higher than in the surrounding soil water; it is caused by active transport of ions and selectivity of the cells; this is accumulation. Accumulation uses energy from respiration for the active transport of ions against a concentration gradient. Aeration and the metabolic state of the root have a greater influence on accumulation than does transpiration. ↓ SELECTIVITY² ↑ MINERALIZATION

FH015 selectivity² (*n.*) The preference of cells for certain ions is called selectivity. This property of cells and their membranes permits a plant to maintain the correct concentration of each ion in its sap, irrespective of the concentrations of ions in its environment; this operates unless the environment is unable to supply sufficient of an ion to meet the plant's requirement. ↑ MINERALIZATION

FH016 potometer (*n.*) An instrument for measuring the rate of movement of the transpiration stream in the stem of a plant. ↓ POROMETER ↑ TRANSPIRATION

FH017 porometer (*n.*) An instrument for estimating the size of all the stomatal openings in a leaf. ↑ POTOMETER

FH018 take up² (*v.t.*) (Of a cell, tissue, or substance) to cause water or any other liquid or vapour, or any solute, to enter because of the physical or chemical properties of the cell, tissue, or substance, *e.g.* ***a*** a flaccid cell takes up water (*i.e.* water diffuses into it), because of the high osmotic pressure in the cell; ***b*** dehydrated silica gel takes up water vapour from the atmosphere because the vapour pressure of water in the gel is lower than the vapour pressure of water in the atmosphere; ***c*** when tetrachloromethane is shaken up with an aqueous solution of iodine, the tetrachloromethane takes up the iodine from the aqueous solution. ↑ TRANSPIRATION

FH019 euryhaline (*adj.*) **1** Describes a plant which can tolerate wide variations in osmotic pressure of soil water. **2** Describes plants and animals which can tolerate conditions of varying salinity, *e.g.* species which live in or near estuaries. ↓ STENOHALINE (An) ↑ TRANSPIRATION

FH020 stenohaline (*adj.*) **1** Describes a plant which cannot tolerate wide variations in the osmotic pressure of soil water. **2** Describes plants and animals which cannot tolerate conditions of varying salinity. ↑ EURYHALINE

FH021 earth (*n.*) The solid substance (excluding rock) on which animals walk, and in which plants have their roots; earth is soft, friable and composed of particles or grains. The focus of the term is on the environment of animals, *e.g.* animals live in the earth or outside the earth; it is also used to describe the physical place in which plants are fixed by their roots. ↓ SOIL · HUMUS · GROUND · WEATHERING · FERTILITY² · FERTILE² ↑ TRANSPIRATION

FH022 soil (*n.*) Earth considered as a chemical environment, the source of nutriment for plants. Soil has various properties depending upon its composition and structure; particle size, called **crumb structure**, is important in deciding many of these properties. Soil properties include: fertility, capillarity, porosity, aeration, water content, acidity or alkalinity. Soils are basically composed of sand, clay, and humus, as solid constituents, together with water and air; they also contain animals and micro-organisms which affect their properties. ↓ ROCK · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC ROCK · SAND · CLAY · SILT · LOAM · GRAVEL · SEDIMENT ↑ EARTH

FH023 rock (*n.*) The hard solid material usually beneath soil forming the outer part of the Earth's crust; it is composed of minerals. Rocks are formed in different ways, and may consist of one mineral, or of a mixture of several minerals. They may also contain dead plant and animal material. The important property of rock is its hardness. Most rocks consist of silicates and aluminates combined with potassium, sodium, calcium, magnesium, and iron; these form the common minerals. Soil is originally formed from rock particles, and these provide the mineral content of a soil. —***rocky*** (*adj.*) ↓ PARENT ROCK ↑ SOIL

FH024 igneous rock (*n.*) Rock formed by the action of intense heat; a molten mass of rock cools and forms a very hard solid mass of igneous rock. ↑ SOIL

FH025 sedimentary rock (*n.*) Sediment originating from igneous rocks is built up in layers; the pressure of the upper layers forms sedimentary rocks in the lower layers. Rocks of this type, such as sandstone and limestone, are much less hard than igneous rocks. ↑ SOIL

FH026 metamorphic rock (*n.*) A type of

rock formed from another kind of rock by the action of heat and great pressure, *e.g.* marble is formed from limestone in this way. ↑ SOIL

FH027 chalk (*n.*) A soft white rock formed from the shells of marine animals; the shells were deposited on a sea-bed over a period of time, then thrust above sea-level by changes in the Earth's crust. ↑ SOIL

FH028 sand (*n.*) A substance composed of separate grains about 0·1 to 1 mm in diameter, formed from rock by weathering; pure sand consists mainly of silica or silicates. Pure sand is extremely porous; in it the capillary rise of water is quick, but other types of soil show a greater rise with time. ↑ SOIL

FH029 clay (*n.*) A substance composed of very fine particles, *i.e.* of diameter less than 0·002 mm, colloidal in nature, formed by the action of carbonic acid on certain rocks; it consists of aluminates and silicates. Pure clay, or kaolin, is a mixture of aluminium and silicon oxides (Al_2O_3, $2SiO_2$, $2H_2O$); it is almost impervious to water. In it capillary rise is very slow, but it eventually exhibits the greatest capillary rise of all types of soil. ↑ SOIL

FH030 silt (*n.*) A substance composed of fine particles, 0·002 to 0·02 mm diameter, intermediate in composition between sand and clay. ↑ SOIL

FH031 loam (*n.*) A substance intermediate between sand and clay, mainly formed as silt. Its physical structure and properties are also intermediate in many cases between sand and clay, but some properties are superior to either; it forms the best type of soil for agricultural purposes. Soils can also be described as sandy loams, or clay loams, depending on their composition. —***loamy*** (*adj.*) ↑ SOIL

FH032 gravel (*n.*) A type of sand with particles greater than 1–2 mm in diameter. ↑ SOIL

FH033 sediment (*n.*) Water-borne particles of earth or rock which settle to the bottom of a water-course when the current becomes too slow to keep the particles suspended □ *sediment is deposited by slow-running streams of water* —***sedimentary*** (*adj.*) ↑ SOIL

FH034 humus (*n.*) The dark brown, or black, organic matter in soils formed from the decomposition of the tissues of dead plants and animals. Humus is colloidal in nature; it improves the crumb structure, the aeration, and the field capacity of soils, and maintains a reserve of mineral elements essential for plant life, such as nitrates. Its colloidal nature permits the adsorption of mineral ions and prevents the ions being leached away; it also provides a substrate for the respiratory and nutritional processes of soil micro-organisms. Humus is only found in topsoil; it is oxidized by strong sunlight. ↓ PEAT[1] ↑ EARTH

FH035 peat[1] (*n.*) Partly decomposed plant remains that accumulate in hollows and wherever the earth is water-logged and acidic, as these conditions slow down plant decomposition. Peat, thus formed, is a precursor of coal, the latter being formed by great pressure on former peat-like substances. ↑ HUMUS

FH036 ground (*n.*) The surface of Earth considered as a level of height, *e.g.* ground-level (the surface of the Earth); underground (in the Earth); above ground (in the air but near the ground). ↓ SEA-LEVEL ↑ EARTH

FH037 sea-level (*n.*) The level of the surface of the sea; used as a reference for measuring the heights of mountains, and thus for comparing the heights of mountains in different parts of the world. ↑ GROUND

FH038 weathering (*n.*) The process by which rocks are transformed into soil. In physical weathering, rain, wind, large temperature changes and plant roots all combine to break down the solid rock into small particles. In chemical weathering, oxidation from atmospheric oxygen is the most important agent, particularly in hot, damp conditions; oxidized rocks readily crumble to soil particles. Carbon dioxide in the atmosphere dissolves in rain and the carbonic acid formed dissolves certain minerals in rocks, particularly chalk. Physical weathering is of greater importance in temperate climates. —***weather*** (*v.*) ↓ FLOCCULATION · SILICA · SILICATES · KAOLIN ↑ EARTH

FH039 flocculation (*n.*) An alkali, such as lime, causes flocculation of clay, in which the tiny colloidal particles coagulate into larger units of soil crumbs. This effect improves crumb structure. ↑ WEATHERING

FH040 silica (*n.*) Silicon dioxide (SiO_2), the commonest substance in sand. ↑ WEATHERING

FH041 silicates (*n.pl.*) Inorganic chemical compounds formed from silica and an oxide of a metal, *e.g.* calcium silicate is formed from silica (SiO_2) and calcium oxide (CaO). ↑ WEATHERING

FH042 kaolin (*n.*) A fine, usually white, clay that is used in ceramics. ↑ CLAY · WEATHERING

FH043 fertility[2] (*n.*) (Of soils) a measure of the ability to produce crops; a property of the soil. ↑ EARTH

FH044 fertile[2] (*adj.*) (Of soil) capable of producing good yields of crops. ↓ INFERTILE[2] (An) · BARREN[2] (An) ↑ EARTH

FH045 infertile[2] (*adj.*) (Of soil) producing poor yields of crops. ↑ FERTILE[2] (An)

FH046 barren[2] (*adj.*) (Of soil) incapable of producing crops. ↑ FERTILE[2] (An)

FH047 soil profile (*n.*) The distinct layers, or horizons, of soil visible in a vertical section through a soil. The basic constitution of a soil profile is: topsoil, subsoil, parent rock. Sub-divisions of the three basic layers may also be visible. A soil profile provides information on the character of the soil. ↓ TOPSOIL · CRUMB STRUCTURE · SAND CULTURE ↑ TRANSPIRATION

FH048 topsoil (*n.*) The top layer of a soil, rarely very thick. In it occurs, *a* bacterial

decomposition of organic material; *b* chemical weathering of minerals; *c* breakdown of insoluble mineral salts. This layer provides the nutrients for intake by roots of plants. ↓ SUBSOIL · PARENT ROCK · HORIZON[2] · PODSOL ↑ SOIL PROFILE

FH049 subsoil (*n.*) The layer of soil between topsoil and the parent rock; it is generally infertile and contains little or no humus. It is less weathered than topsoil. ↑ TOPSOIL

FH050 parent rock (*n.*) Rock underlying subsoil; the soil is formed from the parent rock by weathering. ↑ TOPSOIL

FH051 horizon[2] (*n.*) A soil layer with a fairly well defined character. Topsoil is occasionally called horizon A, and subsoil horizon B. ↑ TOPSOIL

FH052 podsol (*n.*) A white or grey type of soil found in countries in areas with a heavy rainfall and low evaporation. The rain leaches iron salts and other minerals out of the topsoil and deposits them as a hard, dark layer lower down in the subsoil. The topsoil is acidic, and the dark layer is impervious to water; bog vegetation usually develops. ↑ TOPSOIL

FH053 crumb structure (*n.*) The structure formed of small, soft pieces of matter, as found in soil. If the soil crumbs are too large, water retention by capillary action is small; if they are too small, drainage is poor and the soil becomes water-logged, preventing aeration. ↓ SOIL ATMOSPHERE · SOIL pH · SOIL GRANULATION

FH054 soil atmosphere (*n.*) Soil spaces between soil crumbs contain air; when soil is water-logged it contains no air, and roots drown. A good crumb structure provides sufficient air and a good field capacity; both are necessary for plants to thrive. ↑ CRUMB STRUCTURE → FIELD CAPACITY

FH055 soil pH (*n.*) Mineralization by micro-organisms causes variation in the pH of a soil. The majority of plants grow best in a pH of 6 to 7. Soil acidity is corrected by adding lime; soil alkalinity is corrected by adding sulphur. ↓ SOIL SOLUTION ↑ CRUMB STRUCTURE

FH056 soil granulation (*n.*) Alternative term for CRUMB STRUCTURE (↑).

FH057 sand culture (*n.*) An experimental technique in which plants form roots in pure sand (*i.e.* an inert substance) and are supplied with all nutrients in solution; a similar technique to water culture. ↓ WATER CULTURE · HYDROPONICS ↑ SOIL PROFILE

FH058 water culture (*n.*) An experimental technique in which seedlings are grown with their roots dipping into a culture solution containing plant nutrients. The composition of the culture solution can be varied to find the most suitable balance of elements for optimum growth, or to find the effect of deficiencies of essential or trace elements. ↑ SAND CULTURE

FH059 hydroponics (*n.pl.*) Large-scale water culture or sand culture on a commercial basis; the plants are grown with correctly balanced culture solutions. ↑ SAND CULTURE

FH060 soil solution (*n.*) The water in the soil, mainly derived from rain, is a solvent for soluble mineral ions; these together form the soil solution. The roots of plants remove water and dissolved mineral ions from the soil, but cannot remove every trace of water. Some water remains bound by adhesion to soil crumbs. ↓ CAPILLARY WATER · WATER TABLE · EVAPOTRANSPIRATION · DRAIN[1] · IMPERVIOUS ↑ TRANSPIRATION

FH061 capillary water (*n.*) Water retained in the soil after rain is called capillary water; it forms a thin film around the soil crumbs, held by capillary attraction. ↓ DRAINAGE WATER · FIELD CAPACITY · PERMANENT WILTING POINT · GRAVITATIONAL WATER · PWP ↑ SOIL SOLUTION

FH062 drainage water (*n.*) Rain water which drains through a soil is called drainage water; it also drains through permeable rock until it reaches an impervious layer of rock. It leaves behind capillary water in the soil. ↑ CAPILLARY WATER

FH063 field capacity (*n.*) A soil is at field capacity when it contains the maximum amount of capillary water that it can hold. Field capacity varies with the type of soil; it is expressed by the mass of water given as a percentage of the mass of dry soil. Values are of the order: sand, 4·8%; loam, 23·4%; clay, 30·4%. ↑ CAPILLARY WATER

FH064 permanent wilting point (*n.*) The state of a soil when plants have removed all available water, leaving the water adhering to soil crumbs. At this stage, plants wilt from lack of water. It is a measure of the water unavailable to plants in a soil; it is a property of the soil and does not depend upon the plants in the soil. ↑ CAPILLARY WATER

FH065 gravitational water (*n.*) Alternative term for DRAINAGE WATER (↑).

FH066 PWP (*abbr.*) Abbreviation for PERMANENT WILTING POINT. ↑ CAPILLARY WATER

FH067 water table (*n.*) The level in the earth up to which every part of the earth is full of water. If a hole is dug in the earth, the surface of the water is at the water table. The level of the water table rises and falls with the amount of rain. ↓ PERMANENT WATER TABLE ↑ SOIL SOLUTION

FH068 permanent water table (*n.*) The lowest level reached by the water table under any conditions. ↑ WATER TABLE

FH069 evapotranspiration (*n.*) Water is lost from soil by evaporation and plant transpiration. Evaporation only removes water from a shallow depth of soil; the depth depends on the crumb structure of the soil. Evapotranspiration is the combined loss of water by both methods. ↓ LEACHING · SURFACE WATER · EROSION · SHEET EROSION · GULLEY EROSION ↑ SOIL SOLUTION

FH070 leaching (*n.*) The washing away of a soluble substance from a solid mixture. In soil, leaching is the removal of soluble

mineral ions from topsoil by drainage water. Large amounts of nitrates are lost in this way. —LEACH (*v.*) ↑ EVAPOTRANSPIRATION

FH071 surface water (*n.*) The water which runs off the surface of soil during a period of rain. It is liable to wash away the surface of the topsoil, and thus gradually erode the soil. ↑ EVAPOTRANSPIRATION

FH072 erosion (*n.*) The slow destruction and wearing away of a solid, caused by physical and chemical means, *e.g.* the surface of a building can suffer erosion. Soil suffers erosion from the effects of the atmosphere and the weather. Firstly, sunlight promotes oxidation from atmospheric oxygen, and the soil becomes more friable; water then leaches out soluble mineral ions, and the adhesion between soil crumbs is lessened. Heavy rain (the intensity of the rain, and not its duration) washes away the soil, or high winds blow it away. Together these events form the process of erosion □ *sandy soils suffer most erosion; erosion occurs in many tropical countries* —***erode*** (*v.*) ↑ EVAPOTRANSPIRATION

FH073 sheet erosion (*n.*) Uniform erosion of a topsoil over a surface of land. ↑ EVAPOTRANSPIRATION

FH074 gully erosion (*n.*) The formation by erosion of deep, narrow gullies from original shallow gullies or depressions in the earth. ↑ EVAPOTRANSPIRATION

FH075 drain[1] (*v.i.*) (Of liquids) to flow under gravity, either along a channel, or through earth. —***drainage*** (*n.*) ↓ LEACH · DROWN ↑ SOIL SOLUTION

FH076 leach (*v.t.*) To remove soluble substances by leaching. □ *to* leach *nitrates* out *of a soil by rain; rain* leaches out *nitrates* ↑ DRAIN[1]

FH077 drown (*v.t.,i.*) To suffocate or to be suffocated by water or by any liquid. ↑ DRAIN[1]

FH078 impervious[2] (*adj.*) Not allowing the passage of fluid. Contrast **impermeable** which means not allowing the passage of molecules or ions. A membrane can be permeable (allow solute and solvent molecules or ions to pass) but it is impervious, as liquid cannot pass. ↓ WATERLOGGED ↑ SOIL SOLUTION → IMPERMEABLE · PERMEABLE (An)

FH079 waterlogged (*adj.*) Describes a soil saturated with water and excluding air from the crumb structure. Plant roots in a waterlogged soil drown because of the lack of oxygen. ↑ DROWN · IMPERVIOUS[2]

Ecology

GA001 ecology (*n.*) The study of the relationship of plants and animals to their surroundings; the plants and animals are mainly considered in communities, and all surroundings, both inanimate and animate, are included in the study. —***ecological*** (*adj.*) ↓ BIOSPHERE · VEGETATION · BIOME · COLONY · CLINE · POPULATE · INDIGENOUS · EURYTHERMOUS · FOOD CHAIN · PARASITE · FLORA · PLANKTON → AGRICULTURE

GA002 biosphere (*n.*) The part of the earth and atmosphere inhabited by living organisms. ↓ BIOMETRY · BIONOMICS · AUTECOLOGY · SYNECOLOGY · GENECOLOGY · PLANT SOCIOLOGY · DEMOGRAPHY ↑ ECOLOGY

GA003 biometry (*n.*) The statistical study of resemblances and differences between living organisms. —***biometric*** (*adj.*) ↑ BIOSPHERE

GA004 bionomics (*n.*) The study of the relation of organisms to the populations of other organisms in relation to their environment. The term covers a field of study similar to ecology —***bionomic*** (*adj.*) ↑ BIOSPHERE

GA005 autecology (*n.*) The study of the relationship of an individual species with its environment. ↓ SYNECOLOGY (An) ↑ BIOSPHERE

GA006 synecology (*n.*) The ecology of communities. ↑ AUTECOLOGY (An) · BIOSPHERE

GA007 genecology (*n.*) The study of the genetical composition of plant populations in relation to their habitat. ↑ BIOSPHERE

GA008 plant sociology (*n.*) A study of the origin, formation, composition and structure of the plant communities in the vegetation of an observed area. ↑ BIOSPHERE

GA009 demography (*n.*) The study of human populations. —***demographic*** (*adj.*) ↑ BIOSPHERE

GA010 vegetation (*n.*) Plants considered as a covering for the surface of the earth; the plant life in a given area. ↓ POPULATION · QUADRAT · TRANSECT · PRODUCTIVITY · PRIMARY PRODUCTIVITY · GROSS PRODUCTIVITY · NET PRODUCTIVITY · SECONDARY PRODUCTIVITY · TERTIARY PRODUCTIVITY · STANDING CROP · COMPENSATION POINT · POPULATION CYCLE · PHYTOME ↑ ECOLOGY

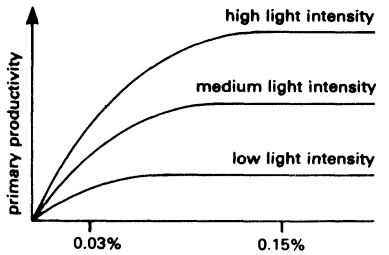
GA011 population (*n.*) The number of plants or animals living in a given area. ↑ VEGETATION

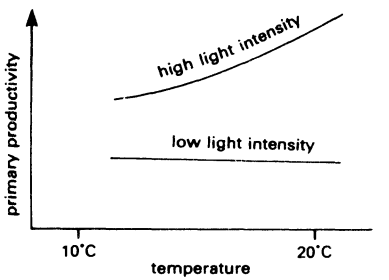
GA012 quadrat (*n.*) A square area of vegetation (the standard size is 1 metre square) selected at random for studying the composition of vegetation in a region. A square frame is often used to define the quadrat. ↑ VEGETATION

GA013 transect (*n.*) A line drawn across a region or a belt of vegetation to define an area before taking samples to study the vegetation or animal population in a region, or the changes accompanying changing features of the region such as water table, soil,

and height. —***transect*** (*v.*) ↑ VEGETATION

GA014 productivity (*n.*) A measurement of the rate of production of organic matter by living organisms, per unit area in unit time, *e.g.* the number of tonnes per hectare per year produced by a crop plant. ↑ VEGETATION





FACTORS AFFECTING PRODUCTIVITY

GA015 primary productivity (*n.*) The rate of production of organic matter by plants as a result of photosynthesis. The three factors which influence the rate are: carbon dioxide concentration in the atmosphere, light intensity, temperature. The carbon dioxide concentration is almost constant at 0·03% by volume, under natural conditions. The effect of the other two factors is shown graphically in the diagram. ↑ VEGETATION

GA016 gross productivity (*n.*) Alternative term for PRIMARY PRODUCTIVITY. ↑ VEGETATION

GA017 net productivity (*n.*) *Primary productivity* results in an increase in organic material, while *respiration* uses up organic material to supply energy for biological work. The *net productivity* is the difference between these two.

Gross Primary Productivity
− Respiratory Loss
= Net Primary Productivity

The net primary productivity is affected by the compensation point; only autotrophs are responsible for net primary productivity. Net primary productivity becomes gross secondary productivity. ↑ VEGETATION

GA018 secondary productivity (*n.*) The rate of production of organic matter by animals. The consumption of plants by herbivores forms the gross secondary productivity (*i.e.* the intake of plant food). The animal loses energy to the ecosystem by respiration. The difference between gross secondary productivity and losses from respiration is the net secondary productivity, and this is available for the tertiary trophic level (the level of predators).

Gross Secondary Productivity
− Respiration Losses by herbivorous animals
= Net Secondary Productivity

GA019 tertiary productivity (*n.*) The net secondary productivity is the gross tertiary productivity. The tertiary trophic level is occupied by the predators in the ecosystem. As in the lower trophic levels, the carnivores lose energy by respiration, and a net tertiary productivity is formed. ↑ VEGETATION

GA020 standing crop (*n.*) The net amount of energy available from one trophic level to the next higher trophic level, *e.g.* ***a*** plants provide the standing crop for herbivores; ***b*** phytoplankton provide the standing crop for zooplankton. ↑ VEGETATION

GA021 compensation point (*n.*) Light intensity controls photosynthesis, but has no effect on respiration. In the dark there is a loss of sugar as photosynthesis ceases but respiration continues. At a certain low light intensity the rate of photosynthesis exactly equals the rate of respiration. This is the compensation point. ↑ VEGETATION → COMPENSATION

GA022 population cycle (*n.*) The periodic rise and fall in the population of a species of animal, *e.g.* some mammals and birds in North America exhibit a 10 year cycle in the rise and fall of the population. ↑ VEGETATION

GA023 phytome (*n.*) An ecological unit of plants, *e.g.* the vegetation in an area. ↑ VEGETATION

GA024 biome (*n.*) A major regional community of living organisms, comprising a complex of climax communities of plants and animals, and extending over large natural areas, *e.g.* tundra, deciduous forest, tropical rain forest, desert, grassland, mountain. A large natural area, the nature of which is determined by climate. ↓ COMMUNITY · ECOSYSTEM · HABITAT · TERRITORY · BIOTIC COMMUNITY · BIOTIC SUCCESSION · BION · ENVIRONMENT[2] ↑ ECOLOGY → CLIMAX

GA025 community (*n.*) A naturally occurring group of different plants and animals inhabiting a common environment; the organisms interact with each other particularly through food relationships, but are relatively independent of other communities. Communities vary greatly in size, and larger communities may contain smaller ones. Rain forests and deciduous forests are examples of large communities. The occurrence and distribution of a plant community depends on three major factors, climate (**climatic** factor); soil (**edaphic**

factor); occurrence of other organisms (**biotic factor**). ↑ BIOME

GA026 ecosystem (*n.*) An ecological system formed by the interaction of the organisms of a community among themselves and with the environment in which they live, *e.g.* a sea-shore, a pond, a forest. An ecosystem comprises: producers, which are autotrophic organisms, mainly green plants; consumers, which are heterotrophic organisms, mainly animals; decomposers, which are also heterotrophic organisms, mainly bacteria and fungi. All these activities are influenced by the physical conditions of the environment. ↑ BIOME

GA027 habitat (*n.*) A locality with a particular kind of environment where an organism lives, *e.g.* a pond, a sea-shore. ↓ ENVIRONMENT ↑ BIOME

GA028 territory (*n.*) An area of ground or a volume of space in a habitat, inhabited by an animal, or family group of animals, for the purposes of feeding and breeding. Other animals entering the territory are attacked. The occupation of a territory is common in vertebrate behaviour; fish, reptiles, birds, and mammals, defend their territories; the extent of the territory is usually marked by scent, or in the case of birds, by singing. A male often occupies the territory alone, being joined by a female for the breeding season. **Territorialism** is a mechanism to prevent too many animals breeding and feeding in one area □ *an animal occupies a territory* —***territorial*** (*adj.*)

GA029 biotic community (*n.*) See COMMUNITY (↑).

GA030 biotic succession (*n.*) The changes appearing in a biotic community arising from environmental changes. The changes in the biotic community also cause further change in the environment. ↑ BIOME → CLIMAX

GA031 bion (*n.*) An individual living organism, *i.e.* a single individual in any ecological system. ↑ BIOME

GA032 environment[2] (*n.*) This term describes the conditions surrounding an organism. The conditions affect the organism in various ways. The environment includes air, water, soil, light, temperature and the presence or absence of other organisms. A permanent change in any one of these conditions, *e.g.* a change in the intensity of the light, is a change in the environment. This can also be called the ***external environment.*** —***environmental*** (*adj.*) ↑ HABITAT · COMMUNITY

GA033 colony (*n.*) Any collection of animals living together; it includes a society such as bees, a group of animals or plants isolated from other groups, a coenobium, a group of incompletely separated unicellular animals, or a culture of micro-organisms. —***colonial*** (*adj.*) ***colonize*** (*v.*) ↓ COENOBIUM · COLONIAL ANIMAL · SOCIETY[1] · CASTE · SYMPHILE ↑ ECOLOGY

GA034 coenobium (*n.*) A colony of algal cells, with no marked distinction between vegetative and reproductive units. A coenobium is composed of a constant number arranged in a specific manner, behaving as a unit, *e.g.* *Volvox*. ↑ COLONY

GA035 colonial animal (*n.*) An animal that is a member of a colony of incompletely separated organisms, *e.g.* Hydrozoa and Polyzoa. The term can also mean an animal in a collection of animals living together, *e.g.* an ant. ↑ COLONY

GA036 society[1] (*n.*) A group of animals living and working together. The three principal forms of labour are: reproduction, defence, foraging. The animals form a community because they live together; in addition, they form a society because they are organized, in some cases by birth, for a division of labour into castes. Contrast a **pack** in which all animals carry out all forms of labour. —SOCIAL (*adj.*) ***sociality*** (*n.*) ↑ COLONY → PACK (Sn) · FLOCK (Sn)

GA037 caste (*n.*) One of the structurally and functionally different forms of adults forming insect societies, such as those of bees, ants, and termites. Honey bees have three castes: queens (fertile females), drones (males), workers (sterile females). Ants have: queens (winged fertile females), winged males, workers (sterile females) who act as foragers and soldiers. In termites, sex and the distinction between castes are not related. There are winged males and females who become kings and queens of nests and produce nymphs; these nymphs develop into wingless individuals of three castes; sterile workers, soldiers, and a reproductive caste. ↑ COLONY

GA038 symphile (*n.*) A social animal living in a society of its own kind, *e.g.* an ant or a bee. ↑ COLONY

GA039 cline (*n.*) A continuous gradation in differences of form observed in the population of a species of organism; the differences correlate with the geographical or ecological distribution of the species. ↓ RELIC · RELIC DISTRIBUTION · DISPERSAL ↑ ECOLOGY → CLONE (I)

GA040 relic (*n.*) An organism, population, or community that has survived over a long period of time and that was common in an earlier time, *e.g.* the king crab, the coelacanth. ↑ CLINE

GA041 relic distribution (*n.*) An isolated population of plants and/or animals surviving in an area that are the remains from a much wider distribution, *e.g.* organisms surviving from the glacial age now restricted to mountain tops. ↑ CLINE

GA042 dispersal (*n.*) The scattering of organisms over the surface of the earth, so that the organism has a wider distribution and a greater chance of finding nourishment. Animals disperse themselves by locomotion into new areas. Plants are dispersed through fruit and seeds by various vectors, *e.g.* ***a*** **wind dispersal** Very light seeds and fruits are blown by the wind to disperse them; the fruit or seed, if not very light, may have a pappus or a wing to assist

dispersal, ***b*** **water dispersal** Some fruits have fibrous layers and impervious coats which enable them to float and be dispersed by water, *e.g.* the coconut. This is not a common method of dispersal. ***c*** **animal dispersal** E'ther a seed or fruit has hooks which attach the fruit or seed to an animal's fur or skin *or* a succulent fruit is eaten by an animal and the seeds are dropped or passed out with the faeces. —DISPERSE (*v.*) ↑ CLINE

GA043 populate (*v.t.*) To be living in countable numbers in a defined area, *e.g.* rabbits, when introduced into Australia, quickly populated the whole country. —***populated*** (*adj.*) ***population*** (*n.*) ↓ FREQUENT · PROLIFERATE ↑ ECOLOGY

GA044 frequent (*v.t.*) To go often to (a particular place), *e.g.* a wide range of animals may frequent the same water hole. ↑ POPULATE

GA045 proliferate (*v.i.*) (Of cells and plants) to reproduce repeatedly and rapidly, *e.g.* ***a*** cells reproducing by binary division, both repeatedly and rapidly, are proliferating; ***b*** plants producing growth by repeated and rapid budding are proliferating. —***proliferation*** (*n.*) ***proliferous*** (*adj.*) ↑ POPULATE → MULTIPLY (Sn)

GA046 indigenous (*adj.*) Describes an organism growing naturally in an area, rather than one that has been introduced, *e.g.* tigers are indigenous to India. ↓ SOCIAL · BIOTIC · COLONIAL · FREE LIVING · MIGRATORY ↑ ECOLOGY

GA047 social (*adj.*) Describes an animal which is part of a society. ↑ INDIGENOUS → SOLITARY (An) · GREGARIOUS (Sn)

GA048 biotic (*adj.*) Concerning living organisms. ↑ INDIGENOUS

GA049 colonial (*adj.*) Of or to do with a colony of animals. ↓ FREE LIVING (An) ↑ INDIGENOUS · COLONIAL ANIMAL

GA050 free living (*adj.*) Describes an animal which exists separately, unattached, and distinct as an individual. ↑ COLONIAL (An) → FREE SWIMMING (H) · FREE DRIFTING (H)

GA051 migratory (*adj.*) Describes a species of animal which changes its habitat regularly according to the season, travelling in groups (flocks, herds). The species has a particular habitat for the time of the year, *e.g.* certain birds, certain fishes, some insects, are migratory animals. —MIGRATION (*n.*) ***migrate*** (*v.*) ↑ INDIGENOUS

GA052 eurythermous (*adj.*) Describes organisms which can tolerate a wide range of temperature. ↓ STENOTHERMOUS · AMBIENT · UNDERGROUND · ARBOREAL · AERIAL[1] ↑ ECOLOGY

GA053 stenothermous (*adj.*) Describes organisms unable to tolerate a wide range of temperature. ↑ EURYTHERMOUS

GA054 ambient (*adj.*) Of or to do with the surroundings of an object or an organism, *e.g.* ***a*** the ambient temperature for a plant is the temperature of the surrounding air; ***b*** the ambient pressure on a liquid in a container is the atmospheric pressure. ↑ EURYTHERMOUS

GA055 underground (*adj.*) Describes an animal, or a part of a plant, which lives beneath the surface of the earth or a place below the surface of the earth, *e.g.* ***a*** a rhizome is an underground stem; ***b*** a mole has an underground nest. ↓ AERIAL[1] (Cn) ↑ EURYTHERMOUS

GA056 arboreal (*adj.*) **1** Of or concerning trees. **2** Describes the habitat of animals living in trees. **3** (Of animals) living in or among trees. ↑ EURYTHERMOUS

GA057 aerial[1] (*adj.*) Describes organisms inhabiting the air, *e.g.* the aerial shoots of a plant. ↓ TERRESTRIAL[2] (Cn) ↑ EURYTHERMOUS · UNDERGROUND (Cn)

GA058 aquatic (*adj.*) Living in or frequenting water ↓ MARINE · ESTUARINE · RIPARIAN · TERRESTRIAL[2] (Cn) · TERRICOLOUS · AMPHIBIAN · AMPHIBIOTIC · AMPHIBIOUS ↑ ECOLOGY

GA059 marine (*adj.*) **1** Of or to do with the sea. **2** Describes organisms living in the sea. ↑ AQUATIC

GA060 estuarine (*adj.*) Describes organisms living in conditions of varying salinity as found at the estuaries of rivers. ↑ AQUATIC → SALINITY

GA061 riparian (*adj.*) Growing in, or living on, or frequenting the banks of rivers or streams. ↑ AQUATIC

GA062 terrestrial[2] (*adj.*) **1** Of or to do with the earth. **2** Describes organisms living on the land. ↑ AERIAL[1] (Cn) · AQUATIC (Cn)

GA063 terricolous (*adj.*) Describes organisms living in the soil. ↑ AQUATIC

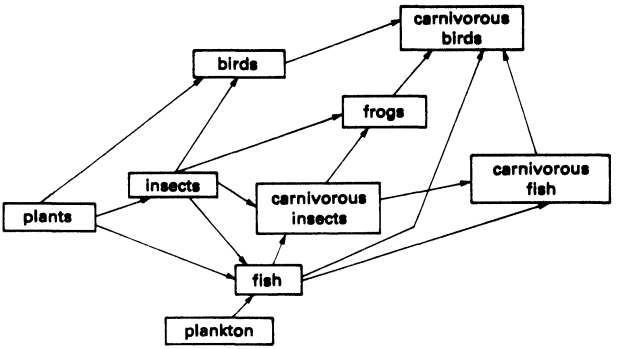
GA064 amphibian (*adj.*) Describes organisms adapted for living in water or on land. —AMPHIBIAN (*n.*) ↑ AQUATIC

GA065 amphibiotic (*adj.*) Describes an organism living in water as a larva and on land as an adult. ↑ AQUATIC

GA066 amphibious (*adj.*) **1** Amphibian. **2** Amphibiotic. **3** Describes an object designed for use on land or water. ↑ AQUATIC

GA067 food chain (*n.*) Each organism in a food chain is eaten by another organism, which either preys on it or parasitizes it. All organisms, including predators, die naturally if not eaten and are decomposed by micro-organisms. This releases carbon dioxide, ammonia, and mineral salts, to return to the environment. The first level of a food chain, the **producer level**, is occupied by green plants. All other levels are **consumer levels**. Herbivores are primary consumers. Carnivores are secondary consumers. The fate of any individual is to be eaten, as in the following food chain; plant leaves – insect – bird – cat – saprophytic bacteria. ↓ FOOD WEB · FAUNA · ADAPTATION[1] · BURROW · ETHOLOGY · PREY (UP)ON · CRYPTOZOIC · TROPHIC ↑ ECOLOGY

GA068 food web (*n.*) All the food chains in an ecosystem are interconnected; together they make up a food web. ↓ PREDATOR · VICTIM · PREY · BIOLOGICAL CONTROL · BIOMASS · TROPHIC LEVEL · ECOLOGICAL PYRAMID · PYRAMID OF NUMBERS · PYRAMID OF BIOMASS · PYRAMID OF ENERGY ↑ FOOD CHAIN



SIMPLIFIED FOOD WEB

GA069 predator (*n.*) An animal that kills its victim and feeds on it; the animal **preys on** its victim —PREY ON (*v.*) ↑ FOOD WEB

GA070 victim (*n.*) An animal suffering an attack by another animal, *e.g.* the injured rat was the victim of an attack by a cat. ↑ FOOD WEB

GA071 prey (*n.sing.*) An animal hunted for food by a predator, *e.g.* frogs are the prey of some species of snakes. ↑ FOOD WEB

GA072 biological control (*n.*) The use of a predator to control the population of another animal which is a pest, *e.g.* ***a*** fish are introduced to eat mosquito larvae; ***b*** herbivores are used to control plant species. ↑ FOOD WEB

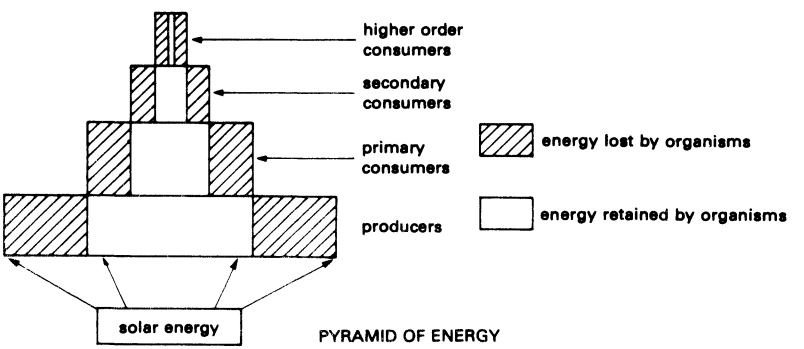
GA073 biomass (*n.*) The total mass of living material under consideration, *e.g.* ***a*** the biomass at a trophic level; ***b*** the biomass of a species per unit area. The biomass of a given species is often calculated from the average mass of an individual and the total number of a species in a given area. ↑ FOOD WEB

GA074 trophic level (*n.*) One of the different levels into which a food chain or food web can be divided. Producers, primary consumers, secondary consumers, etc., each feed at a different trophic level. ↑ FOOD WEB

GA075 ecological pyramid (*n.*) A diagram used to show ecological relationships between different trophic levels. Because of the energy losses by respiration in going from one trophic level to the next, the diagram is always shaped like a pyramid. Quantities for such diagrams are obtained from field data. ↑ FOOD WEB

GA076 pyramid of numbers (*n.*) The number of organisms at a trophic level; this is not a useful representation as one tree, for example, can support many arthropods. ↑ FOOD WEB

GA077 pyramid of biomass (*n.*) The biomass at each trophic level of producers, primary consumers, and higher levels of consumers. It is a more accurate representation of the relationship between the trophic levels, especially if carried over a period of time to avoid the effect of temporary fluctuations. As the trophic levels are ascended, the amount of biomass always decreases. ↑ FOOD WEB



PYRAMID OF ENERGY

GA078 pyramid of energy (*n.*) A representation of the energy lost and the energy retained in the different trophic levels. The energy is lost, mainly as heat, from the living system as a result of respiration and returned to the environment. Such pyramids give the most useful quantitative picture of ecosystems, as they overcome the difficulties in equating animals of different sizes, as in pyramids of numbers, or of different turnover rates, as in pyramids of biomass. ↑ FOOD WEB

GA079 fauna (*n.pl.*) The animal population of a defined region or at a certain epoch. ↓ HERD · PACK · FLOCK · SWARM · EMIGRATION · MIGRATION · ADAPTIVE RADIATION ↑ FOOD CHAIN

GA080 herd (*n.*) A number of herbivorous animals moving and feeding together; the herd provides protection from predators, as solitary individuals are more likely to fall prey to carnivores, *e.g.* a herd of cattle; a herd of elephants; a herd of antelope. ↑ FAUNA

GA081 pack (*n.*) A group of mammalian predators, such as wolves, which form a group to hunt their prey. Contrast **herd**. ↑ FAUNA · HERD

GA082 flock (*n.*) A large number of birds or mammals (*e.g.* sheep or goats), usually gathered together for a definite purpose, such as feeding, migration, or defence. ↑ FAUNA

GA083 swarm (*n.*) A large number of insects; the term is used especially of bees when migrating to another hive, or of locusts migrating in search of food. —***swarm*** (*v.*) ↑ FAUNA

GA084 emigration (*n.*) The permanent mass movement of animals from a particular habitat, without a return journey. Such journeys are random and usually occur at times of high population density, *e.g.* ***a*** the emigration of lemmings; ***b*** the emigration of locust hordes. ↑ FAUNA

GA085 migration (*n.*) An instinctive, regular, and usually seasonal, mass journeying of animals. Journeys (in opposite directions) usually take place in summer and winter, or spring and autumn, *e.g.* ***a*** fish, such as salmon, go to spawning grounds in rivers and then return to the sea; ***b*** birds, such as swallows, fly from Europe to Africa, and then back from Africa to Europe. The birds gather into flocks before migration and the flock flies as a whole; such journeys can be extremely long, up to thousands of kilometres. ↑ FAUNA

GA086 adaptive radiation (*n.*) The spread of a species of animal into different habitats, resulting through natural selection in changes of structure more suited for life in the new habitat. When such individuals become reproductively isolated the production of new species can result. ↑ FAUNA

GA087 adaptation[1] (*n.*) **1 Physiological adaptation** is a change in an organism which takes place when the environment changes and the organism adjusts itself to suit the changed environment, *e.g.* estuarine animals can adapt to salinity changes. **2 Evolutionary adaptation** is the slow change in organisms through the selection of different characteristics to survive the changing conditions in the Earth's development. Such adaptations take place over many thousands or millions of years. ↓ MIMICRY · PROTECTIVE RESEMBLANCE · CRYPTIC COLORATION · BATESIAN MIMICRY · MÜLLERIAN MIMICRY · SPECIALIZATION[2] ↑ FOOD CHAIN

GA088 mimicry (*n.*) Similarity in appearance between animals which provides protection from predators, *e.g.* one species, which is attacked by predators, resembles another species which is not attacked, so the predators leave alone both species. In **Batesian mimicry**, one species is poisonous, or has a distasteful flavour, or is otherwise protected from predators; this species is called the **model**, and is often conspicuously marked (aposematic coloration); the species resembling it, innocuous to predators, is called the **mimic**; the mimic gains protection by its mimicry. In **Müllerian mimicry**, both species are distasteful to predators, and resemble each other; the advantage is that predators learn to avoid both species after eating a smaller number of each. In this type of mimicry, the more species adopting the same mimicry, the better for all. Insects exhibit mimicry more than other animals. —***mimic*** (*n.*) ***mimic*** (*v.*) ↑ ADAPTATION[1]

GA089 protective resemblance (*n.*) (Of an animal) resemblance to an object, or to some part of the surroundings, *e.g.* a stick insect looks exactly like a twig. The resemblance gives the animal some protection against predators. Insects in particular exhibit protective resemblance to a great degree; this has been brought about by natural selection. Mimicry is a particular form of protective resemblance. ↑ ADAPTATION[1] · MIMICRY (H)

GA090 cryptic coloration (*n.*) The coloration and pattern of colours which make an animal less visible against its natural background, *e.g.* stripes on a tiger break up the outline of the body, and make the animal less visible to its prey. ↑ ADAPTATION[1]

GA091 Batesian mimicry (*n.*) See MIMICRY above. ↑ ADAPTATION[1]

GA092 Müllerian mimicry (*n.*) See MIMICRY above. ↑ ADAPTATION[1]

GA093 specialization[2] (*n.*) The acquisition of special adaptations to a mode of life, including adaptations to a particular habitat. This process results in a considerable divergence from the characteristics of the ancestors of the species and the possibility of future evolution can become limited because of this restriction in mode of life or of habitat. ↑ ADAPTATION[1]

GA094 burrow (*n.*) A hole in the ground dug by an animal such as a rabbit or a mole, the burrow usually leads to a nest

GA095 ethology (*n.*) The study of animal

behaviour in a normal environment. ↓ ALLEN'S LAW ↑ FOOD CHAIN

GA096 Allen's law (*n.*) The general rule that the feet, tails, snouts and ears of mammals have a tendency to be shorter in cold climates. Reduction in size reduces heat loss, an advantage in a cold climate. ↑ ETHOLOGY

GA097 prey (np)on (*v.t.*) To use a type of animal as a source of food, *e.g.* lions prey on zebras (zebras are a source of food for lions) —***prey, predator*** (*n.*) ↑ FOOD CHAIN

GA098 cryptozoic (*adj.*) (Of animals) living in cracks and crevices, under stones and leaves, etc., hidden from view. ↓ APOSEMATIC · EPIGEAL[2] ↑ FOOD CHAIN

GA099 aposematic (*adj.*) Having conspicuous colours or markings which frighten enemies away, *e.g.* yellow bands on snakes. Yellow and black, or red and black, are the usual signs of danger in coloration. ↑ CRYPTOZOIC

GA100 epigeal[2] (*adj.*) (Of insects) living exposed on the surface of the soil. ↑ CRYPTOZOIC → EPIGEAL[1]

GA101 trophic (*adj.*) Of or to do with food supply or obtaining nutrition, *e.g.* green plants have a one-way trophic relationship with all other organisms. ↑ FOOD CHAIN

GA102 parasite (*n.*) An animal or plant that lives in or on, and obtains its food from, another living organism, the host. The parasite may or may not cause the host harm. All parasites show a degree of specificity; they have a limited number of host species. —***parasitize*** (*v.*) PARASITIC (*adj.*) ***parasitism*** (*n.*) ↓ ECTOPARASITE · SAPROPHYTE · PARASITIC · EPIGENOUS ↑ ECOLOGY → PATHOGEN (H)

GA103 ectoparasite (*n.*) An organism which is a parasite living externally on its host, *e.g.* a flea. ↓ ENDOPARASITE · HYPERPARASITE · FACULTATIVE PARASITE · OBLIGATE PARASITE · BIOPHYTE · HOST[1] ↑ PARASITE

GA104 endoparasite (*n.*) An organism which is a parasite living internally within its host, *e.g.* a tapeworm. ↑ ECTOPARASITE

GA105 hyperparasite (*n.*) A parasite whose host is itself a parasite. ↑ ECTOPARASITE

GA106 facultative parasite (*n.*) An organism which can live as a saprophyte but under certain conditions can live as a parasite. ↑ ECTOPARASITE

GA107 obligate parasite (*n.*) An organism which can live only as a parasite. ↑ ECTOPARASITE

GA108 biophyte (*n.*) A plant obtaining organic matter in solution from living organisms. ↑ ECTOPARASITE

GA109 host[1] (*n.*) The organism from which a parasite obtains its nutrition. An **intermediate host** is one which is essential for the life cycle of an animal parasite, *e.g.* the mosquito is an intermediate host to *Plasmodium* (the agent of malaria). A **definitive host** is one in which an animal parasite reaches sexual maturity, *e.g.* man is the definitive host for *Plasmodium*. ↑ ECTOPARASITE

GA110 saprophyte (*n.*) An organism which can live on and obtain nutrients from dead and decaying tissues of plants and animals, *e.g.* fungi and certain bacteria are saprophytes. —SAPROPHYTIC (*adj.*) ***saprophytism*** (*n.*) ↓ EPIPHYTE · EPIZOITE · SYMBIOSIS · SYMBIONT · COMMENSALISM · INQUILINE · MYCORRHIZA ↑ PARASITE → FERMENTATION · PUTREFACTION · BACTERIA

GA111 epiphyte (*n.*) A plant which grows on another plant but attaches itself to the other plant only for support, *e.g.* mosses and orchids. An epiphyte does not obtain nutrition from the supporting plant. ↑ SAPROPHYTE

GA112 epizoite (*n.*) A non-parasitic, sedentary animal living attached to another animal, *e.g.* a barnacle. ↑ SAPROPHYTE

GA113 symbiosis (*n.*) An association of two dissimilar organisms living together for the nutritional benefit of each other, *e.g.* the nitrogenous bacteria in nodules on the roots of legumes. The two partners cannot live without each other, *e.g.* nitrogenous. —SYMBIONT (*n.*) ***symbiotic*** (*adj.*) ↑ SAPROPHYTE

GA114 symbiont (*n.*) Either of the two partners associated in symbiosis, *e.g.* when nitrogenous bacteria and a bean plant exhibit symbiosis, either the bacteria or the bean plant is a symbiont. ↑ SAPROPHYTE

GA115 commensalism (*n.*) (Of two or more different types of animal) being in close association, as when sharing the same shell or burrow, but not necessarily having much influence on each other, *e.g.* different species of barnacles living on the same shell of a crustacean. —***commensal*** (*adj.*) ↑ SAPROPHYTE

GA116 inquiline (*n.*) An animal living in the home of an animal of a different kind, and getting a share of the food; a partner in commensalism. ↑ SAPROPHYTE

GA117 mycorrhiza (*n.*) The symbiosis of a fungal mycelium with the roots of a higher plant, including the radicle of a seed, *e.g.* the symbiotic association between the germinating seedling of an orchid and a fungal mycelium, the fungus supplying carbohydrate to the seedling. —***mycorrhizic*** (*adj.*) ↑ SAPROPHYTE

GA118 parasitic (*adj.*) **1** Describes the mode of nutrition of a parasite. **2** Of or like a parasite. ↓ SAPROPHYTIC · PISCICOLOUS · FUNGICOLOUS ↑ PARASITE

GA119 saprophytic (*adj.*) **1** Describes the mode of nutrition of a saprophyte. **2** Of, or like, a saprophyte. ↑ PARASITIC

GA120 piscicolous (*adj.*) (Of parasites) living inside fish. ↑ PARASITIC

GA121 fungicolous (*adj.*) (Of organisms) living in or on fungi. ↑ PARASITIC

GA122 epigenous (*adj.*) Developing or growing on a surface. ↓ HYPOGENOUS (An) · HYPOGEOUS ↑ PARASITE · EPIGEAL[2]

GA123 hypogenous (*adj.*) Developing or growing on a lower surface, *e.g.* the sori of ferns are hypogenous (they grow on the undersurface of the fronds). ↑ EPIGENOUS (An)

GA124 hypogeous (*adj.*) Developing or growing under the surface of the soil, *e.g.* rhizomes and most roots are hypogeous. ↑ EPIGENOUS → HYPOGEAL

GA125 flora (*n.*) **1** The plant population of an area, a country, a specified environment, or of a period. **2** A list of plants, with descriptions, arranged in families, genera and species, together with a key for identification. A flora is usually confined to a particular area. ↓ CLIMAX · MESOPHYTE · WEED[1] · BIOTIC FACTORS · MARSH · SERE · PEAT[2] · ARID · DOMINANT[2] · SALINE ↑ ECOLOGY

GA126 climax (*n.*) A plant community, the composition of which is more or less stable, and whose character is determined by the existing climatic conditions; it is in equilibrium with the existing environmental conditions and represents the typical final community of an area without human or other interference. ↓ SUCCESSION · FORMATION[2] · ASSOCIATION[1] · CONSOCIATION · SOCIETY[2] · MYCOBIOTA ↑ FLORA

GA127 succession (*n.*) The progressive change in the composition of the plant species of an area from the initial colonization to the attainment of the climax population. Compare **biotic succession** which describes the changes for all organisms. ↑ CLIMAX → BIOTIC SUCCESSION

GA128 formation[2] (*n.*) A climax community of plants in a biome. The plant formations are the important natural vegetation types of the world. ↑ CLIMAX → BIOME

GA129 association[1] (*n.*) **1** A climax plant community in which more than one species is dominant; it is named according to the dominant species of plants, *e.g.* ***a*** a heath association; ***b*** a deciduous forest association. **2** In more modern usage the term is applied to a very small unit of natural vegetation. ↑ CLIMAX → COMMUNITY

GA130 consociation (*n.*) A climax plant unit dominated by one particular species, *e.g.* an oak forest is a consociation. ↑ CLIMAX

GA131 society[2] (*n.*) A small plant climax community occurring inside an association or a consociation, arising as a result of local variation in conditions. Such a society is dominated by species other than those of the external communities. ↑ CLIMAX

GA132 mycobiota The fungi inhabiting an area, region, or habitat. ↑ CLIMAX

GA133 mesophyte (*n.*) A plant living under conditions of normal water supply. ↓ XEROPHYTE · HYDROPHYTE · CRYOPHYTE · HALOPHYTE · XEROMORPH · OXYPHYTE · OXYPHOBE ↑ FLORA

GA134 xerophyte (*n.*) A plant adapted to withstand a dry habitat, or to endure conditions of prolonged drought, as in areas of low rainfall, such as deserts. The characteristic features of xerophytes include, ***a*** leaves reduced to spines; ***b*** sunken stomata; ***c*** shedding of leaves when water supply is exhausted; ***d*** waxy leaves; ***e*** heavily cutinized leaves; ***f*** folding of leaves or orientation of leaves to reduce exposure to the sun's rays; ***g*** possession of water storage tissue. —***xerophytic*** (*adj.*) ↑ MESOPHYTE

GA135 hydrophyte (*n.*) A plant normally growing in water or in very wet places; it characteristically possesses aerenchyma. ↑ MESOPHYTE

GA136 cryophyte (*n.*) A plant growing on ice or snow, *e.g.* small plants such as algae, fungi, mosses; bacteria are also present. Algae are the most prominent species. ↑ MESOPHYTE

GA137 halophyte (*n.*) A plant able to tolerate very salty soil such as found in the banks and shores of estuaries. ↑ MESOPHYTE

GA138 xeromorph (*n.*) A plant with characteristics similar to those of a xerophyte, but not capable of withstanding the same dry conditions, *e.g.* many salt-marsh plants are xeromorphs. ↑ MESOPHYTE

GA139 oxyphyte (*n.*) A plant which thrives on acid soils. ↑ MESOPHYTE

GA140 oxyphobe (*n.*) A plant which is unable to tolerate acid soils. ↑ MESOPHYTE

GA141 weed[1] (*n.*) A plant growing out of place amongst cultivated plants, or a plant occurring on wasteland or uncultivated land. Weeds are characterized by high seed production and the ability to colonize new areas quickly and compete effectively with other plants. The two main types of weeds are, ***a*** those with several generations a year, *i.e.* small quick-growing plants; ***b*** perennial plants with creeping rootstocks, *e.g.* some grasses. ↓ ESCAPE · RUDERAL ↑ FLORAL

GA142 escape (*n.*) A plant originally cultivated, found growing wild. ↑ WEED[1]

GA143 ruderal (*n.*) A plant typically growing among rubbish or debris on waste-land near houses, dwellings, etc. ↑ WEED[1]

GA144 biotic factors (*n.pl.*) Living organisms which influence, by their activity in an environment, an animal or community of animals. These factors are distinct from climatic factors. ↓ EDAPHIC FACTORS · ARIDITY INDEX · RHIZOSPHERE · SALINITY ↑ FLORA

GA145 edaphic factors (*n.pl.*) Environmental conditions arising from the physical, chemical, and biological characteristics of the soil. ↑ BIOTIC FACTORS

GA146 aridity index (*n.*) A measure of drought in a region. If P is the average monthly rainfall in mm, T is the average monthly temperature in °C, then

$$\text{aridity index} = \frac{12\,P}{T + 10}$$

If the aridity index is less than 20, it is a dry month; if greater than 20, it is a humid month. ↑ BIOTIC FACTORS

GA147 rhizosphere (*n.*) The soil immediately surrounding the root system of a plant; it is influenced by the absorption of water and mineral salts through the root hairs, and also by plant excretions. ↑ BIOTIC FACTORS

GA148 salinity (*n.*) The measure of the concentration of sodium chloride (common salt) in a solution, or in a soil, *e.g.* the salinity of sea water is higher than that of blood plasma. ↑ BIOTIC FACTORS

GA149 marsh (*n.*) A community dominated by rushes and similar plants; a region of waterlogged ground, with soil mainly composed of mineral matter. There is no accumulation of peat. ↓ BOG · FEN · HEATH · MOOR · SAVANNA · TUNDRA · SCRUB ↑ FLORA

GA150 bog (*n.*) A community dominated by mosses; found in regions of high rainfall and poor drainage, the soil being leached and acidic. The surface of a bog is rarely even and always soft. The mosses grow and raise the level of the bog, forming peat at the same time. When a bog dries out it develops into a moor. ↑ MARSH

GA151 fen (*n.*) A community dominated by reeds and sedges, developing in water overlying alkaline rocks. The bottom is built up from mineral particles and partially decayed plants. Peat is formed, as waterlogging prevents bacterial decay. The surface of the peat rises, and it may then be colonized by trees; or if the rise is sufficient, by mosses, changing the fen into a bog eventually. Fen peat is alkaline and darker than bog peat. ↑ MARSH

GA152 heath (*n.*) A community dominated by heather, found in temperate regions with acidic, sandy soil of low fertility. A thin layer of peat is usually found beneath the surface. ↑ MARSH

GA153 moor (*n.*) A community dominated by heather, and by other plants preferring a dry acidic soil. Normally formed from a dried-out bog. ↑ MARSH

GA154 savanna *or* **savannah** (*n.*) Open flat country without trees or with a few small trees, otherwise mainly covered in grass; the climate is dry and hot. ↑ MARSH

GA155 tundra (*n.*) A region of the Earth near to the geographical poles; it is frozen for most of the year, but supports some plant life. It is beyond the tree line, but a few stunted bushes grow, as do some small plants (cryophytes mainly). The majority of plant life consists of mosses and lichens. ↑ MARSH → CRYOPHYTE

GA156 scrub (*n.*) A community dominated by bushes and shrubs; soil conditions are similar to those of savanna. ↑ MARSH

GA157 sere (*n.*) A particular example of a succession, *e.g.* hydroseres, xeroseres, lithoseres. ↓ HYDROSERE · LITHOSERE · XEROSERE · PRISERE · CLISERE · PLAGIOSERE · PLAGIOCLIMAX ↑ FLORA

GA158 hydrosere (*n.*) A sere which starts in water or in moist or damp surroundings ↑ SERE

GA159 lithosere (*n.*) A sere originating on the exposed surface of a rock. ↑ SERE

GA160 xerosere (*n.*) A sere which starts in dry surroundings. ↑ SERE

GA161 prisere (*n.*) A primary sere from bare habitat to climax. ↓ PLAGIOSERE (An) ↑ SERE

GA162 clisere (*n.*) A succession of communities in an area resulting from climatic changes. ↑ SERE

GA163 plagiosere (*n.*) A plant succession which has deviated from its normal course of development because of external biotic factors, such as human interference. ↓ PLAGIOCLIMAX (Cs) ↑ SERE · SUCCESSION · CLIMAX · PRISERE (An)

GA164 plagioclimax (*n.*) The climax of a plagiosere ↑ SERE · CLIMAX

GA165 peat[2] (*n.*) Partly decayed plant material formed under waterlogged conditions where bacterial activity is slowed down. Peat is formed in bogs (from decayed moss) and in fens (from sedges and heathers). ↓ RADIOLARIAN OOZE ↑ FLORA · BOG

GA166 radiolarian ooze (*n.*) A type of red clay on the sea-bed formed from the siliceous skeletons of radiolarians. ↑ PEAT[2]

GA167 arid (*adj.*) Describes a region which is dry and barren with insufficient rainfall to support vegetation. ↓ XEROPHILOUS · XEROMORPHIC · EURYHALINE · STENOHALINE · EURYHYGRIC · STENOHYGRIC · CALCICOLE · CALCIFUGE ↑ FLORA · ARIDITY INDEX

GA168 xerophilous (*adj.*) Describes plants living under very dry conditions. ↑ ARID

GA169 xeromorphic (*adj.*) Describes a plant with the morphological characteristics of xerophytes. —***xeromorphy***, XEROMORPH (*n.*) ↑ ARID

GA170 euryhaline (*adj.*) See **FH019.**

GA171 stenohaline (*adj.*) See **FH020.**

GA172 euryhygric (*adj.*) Describes organisms that can tolerate a wide range of atmospheric humidity. ↓ STENOHYGRIC (An) ↑ ARID

GA173 stenohygric (*adj.*) Describes organisms that can tolerate only a narrow variation in atmospheric humidity. ↑ ARID · EURYHYGRIC (An)

GA174 calcicole (*n.*) A plant which thrives in soils with a high calcium ion content, *i.e.* a chalky soil. —***calcicolous*** (*adj.*) ↓ CALCIFUGE (Cn) ↑ ARID

GA175 calcifuge (*n.*) A plant which thrives only in soils with a low calcium ion content. ↑ ARID · CALCICOLE (Cn)

GA176 dominant[2] (*adj.*) Describes the major plant species in a community which, by its population and extent, determines the type and abundance of other species in the same community. ↓ SYMPATRIC · ALLOPATRIC ↑ FLORA

GA177 sympatric (*adj.*) Describes different species or sub-species which have the same or overlapping areas of geographical distribution. ↓ ALLOPATRIC (An) ↑ DOMINANT[2]

GA178 allopatric (*adj.*) Describes different species or sub-species which do not have the same area of geographical distribution. ↑ DOMINANT[2]

GA179 saline (*adj.*) Made of or containing sodium chloride (common salt), *e.g.* a saline solution is made with sodium chloride. ↓ OXYPHILOUS ↑ FLORA

GA180 oxyphilous (*adj.*) Describes a plant living only on acid soils. ↑ SALINE

GA181 plankton (*n.*) Very small plants and animals living in water, either in lakes or in the sea; mostly they have no power of locomotion and drift or float with the

currents. They live near the surface of the water, where they get sufficient sunlight. Plankton are of great ecological importance as they provide food for fish and for whales, and are the starting point of many food-chains. ↓ PHYTOPLANKTON · BENTHOS · NERITIC · EUTROPHIC · FREE SWIMMING ↑ ECOLOGY

GA182 phytoplankton (*n.*) Plant plankton which float near the surface of the seas and lakes in order to have the light necessary for photosynthesis. ↓ ZOOPLANKTON · NANOPLANKTON · NANNOPLANKTON · MICROPLANKTON · BENTHON · NEKTON · MORPHOPLANKTON · PLANKTER ↑ PLANKTON

GA183 zooplankton (*n.*) Animal types of plankton; a collective term for small drifting animals in seas, lakes, etc. ↑ PHYTOPLANKTON

GA184 nanoplankton (*n.*) The smallest forms of plankton; the term includes diatoms. ↑ PHYTOPLANKTON

GA185 nannoplankton (*n.*) Alternative term for NANOPLANKTON. ↑ PHYTOPLANKTON

GA186 microplankton (*n.*) Plankton a little larger than nanoplankton. ↑ PHYTOPLANKTON

GA187 benthon (*n.*) The plants and animals living on or attached to the sea-bottom. —BENTHIC (*adj.*) ↑ PHYTOPLANKTON

GA188 nekton (*n.*) Animals swimming in the pelagic zone of a lake or the sea; they include types of fish and whales. ↑ PHYTOPLANKTON · PLANKTON (An)

GA189 morphoplankton (*n.*) Free-drifting plankton which are buoyant because of their small size or body shape. ↑ PHYTOPLANKTON

GA190 plankter (*n.*) An individual member of the plankton; the term can be modified by prefixes, *e.g.* phytoplankter. ↑ PHYTOPLANKTON

GA191 benthos (*n.*) The surface of the sea-bed or bottom of the sea (sea bottom). ↓ PELAGIC ZONE · EUPHOTIC ZONE · COMPENSATION DEPTH · FRESHWATER ↑ PLANKTON

GA192 pelagic zone (*n.*) That part of the sea which is not above the littoral except at high tide, or that part of the ocean above the benthos. ↓ LITTORAL ↑ BENTHOS

GA193 euphotic zone (*n.*) The upper zone of the sea (up to 100 m deep), where the light intensity is sufficient to permit photosynthesis to take place. The depth of the zone varies dependent upon the amount of dissolved solids, *e.g.* a river estuary containing muddy water has a much shallower euphotic zone than the open sea. ↑ BENTHOS

GA194 compensation depth (*n.*) The depth in sea or lakes, at which the rate of respiration of plants is exactly equal to the rate of photosynthesis; below this point the plant cannot grow. The depth may be 100 m, but is usually much less; it depends on the intensity of the sunlight and the turbidity of the water. ↑ BENTHOS → COMPENSATION POINT

GA195 freshwater (*n.*) Water in rivers and lakes, *i.e.* it does not contain common salt as does the sea. ↑ BENTHOS

GA196 neritic (*adj.*) Inhabiting the sea in the region of the continental shelf, or the sea where it is 200 m or less in depth. ↓ OCEANIC (An) · ABYSSAL · PELAGIC · LITTORAL · DEMERSAL · BENTHIC ↑ PLANKTON

GA197 oceanic (*adj.*) Inhabiting the sea where the depth is greater than 200 m. Oceanic organisms are spread over all depths of the sea; the term describes the habitat from surface to sea-bed. ↑ NERITIC (An)

GA198 abyssal (*adj.*) **1** Living in the lower depths of the sea, *i.e.* where it is more than 1000 m deep. **2** Concerning this region of the sea. ↑ NERITIC

GA199 pelagic (*adj.*) Describes organisms which inhabit the sea or a lake, and are free-floating or actively swimming as opposed to those organisms which inhabit the bed or bottom of the sea or a lake. Pelagic animals consist of plankton and nekton. ↑ NERITIC

GA200 littoral (*adj.*) Describes organisms living on the sea-bed or bottom of a lake near to the shore. The depth is such that light reaches the sea-bed or lake-bottom, and wave action has an effect. The term generally describes the region below the high tide mark up to a sea depth of 200 m and up to a lake depth of 20 m.

GA201 demersal (*adj.*) Describes free-swimming organisms living on the bottom of seas and lakes, *e.g.* rays (of the genus *Raia*) and flatfish are demersal organisms. ↓ BENTHIC (An) ↑ NERITIC · PELAGIC (Cn)

GA202 benthic (*adj.*) Of or belonging to benthon. ↑ NERITIC · PELAGIC (An)

GA203 eutrophic (*adj.*) (Of lakes) providing a good supply of nutrients; being highly productive of organic matter. ↓ OLIGOTROPHIC (An) ↑ PLANKTON

GA204 oligotrophic (*adj.*) (Of lakes) providing a poor supply of nutrients; being poorly productive of organic matter. ↑ EUTROPHIC (An)

GA205 free swimming (*adj.*) Describes separate, unattached, individual animals which swim actively to prevent sinking and are mobile in water, *e.g.* fish in the ocean are free swimming. ↓ FREE DRIFTING ↑ PLANKTON

GA206 free drifting (*adj.*) Describes separate, unattached, non-motile individuals which drift submerged in water, carried by currents, *e.g.* phytoplankton are free-drifting and reduce their density by producing mucilage sheaths to prevent sinking. ↑ FREE SWIMMING → DRIFT

Agriculture

GB001 agriculture (*n.*) The methods of large scale cultivation □ *the practice of agriculture* —***agricultural*** (*adj.*) ↓ PRACTICE · SEASON · SOIL CONSERVATION · MULCH · FALLOW · FARMING · CROP[1] · VEGETATIVE PROPAGATION → ECOLOGY

GB002 practice (*n.*) An accepted way of performing work for a specific purpose, *e.g.* *a* agricultural work such as the practice of contour ploughing; *b* the practice of growing cover crops —(in both cases the purpose is the avoidance of erosion). ↓ CROP ROTATION · IRRIGATION · BUSH-FALLOW · SHIFTING CULTIVATION · NURSERY

GB003 crop rotation (*n.*) A system of agriculture used in most temperate climates, but not ideally suited to tropical climates. The crops planted in a field are changed each year, with the field left fallow, or used for grazing cattle, every second or every fourth year. The *rotation of crops, i.e.* the successive crops planted, can be a cereal, a legume, and a root vegetable. The legume increases the nitrogen content of the soil, and the fallow year allows the soil to recover from cultivation. By not growing the same crop year after year, pests peculiar to that crop are discouraged. ↑ PRACTICE

GB004 irrigation (*n.*) **1** The natural process of rivers supplying water to the soil. **2** An artificial process of agriculture using a system of canals and channels, dug by man, to supply water to the soil. This method of agriculture is used in areas where rainfall is scanty. ↑ PRACTICE

GB005 bush-fallow (*n.*) A system of agriculture followed in several tropical countries (particularly Africa). A piece of land is cleared of bush by burning and crops planted on it for one or two years. The piece is then left fallow for 7–10 years; after that the practice is repeated. ↑ PRACTICE

GB006 shifting cultivation (*n.*) Practised in some tropical countries, it is not a good system of agriculture: land is cultivated for 1–3 years, and becomes exhausted. The people then move to another area and repeat the process. ↑ PRACTICE

GB007 nursery (*n.*) A place where seedlings or young plants are grown from seeds with special care, before transplanting to fields. ↑ PRACTICE

GB008 season (*n.*) **1** A part of the year characterized by particular weather conditions, *e.g.* the monsoon season when the monsoon blows; the autumn season when the temperature falls and deciduous trees shed their leaves. Temperate climates and sub-tropical climates have four seasons: spring, summer, autumn, winter. **2** The time of the year when plants produce seeds or fruits, *e.g.* peas are in season early in the summer ↓ RAINFALL ↑ AGRICULTURE

GB009 rainfall (*n.*) The quantity of rain that falls in a given time (usually measured monthly or annually) in a given area. Rainfall can be high, moderate, low or scanty. ↑ SEASON

GB010 soil conservation (*n.*) The maintenance of soil fertility by preventing erosion; the methods employed include: terracing of slopes, contour ridging, contour ploughing, contour drainage, strip cropping, use of cover crops and mulching. ↓ CONTOUR · CONTOUR RIDGING · TERRACING · STRIP CROPPING · COVER CROP ↑ AGRICULTURE

GB011 contour (*n.*) An imaginary line on a slope connecting all points at the same height above sea-level. Water on a slope drains from a higher to a lower contour but never along a contour. Any wall or any structure built along a contour is said to follow the contour. ↑ SOIL CONSERVATION

GB012 contour ridging (*n.*) Ridges of earth are made on a slope so that they follow the contours of the slope. The ridges prevent surface water running straight down the slope and eroding the soil. ↑ SOIL CONSERVATION

GB013 terracing (*n.*) Making narrow strips like shelves of level ground on a slope by building low walls and levelling the soil behind each wall. Terraces made in this way follow the contours of the slope. In padi cultivation, the strips of land are flooded to form padi swamps. ↑ SOIL CONSERVATION

GB014 strip cropping (*n.*) A field is divided into strips, and the strips follow the contours of a hill slope. Each strip is used for a different crop, usually in accordance with crop rotation; the crops are planted so that adjacent strips do not have exposed soil. This practice prevents erosion. ↑ SOIL CONSERVATION

GB015 cover crop (*n.*) A crop grown to cover the surface of the soil and to prevent the soil from being baked by sunlight. The crop is not usually of commercial value, but in some cases a crop of commercial value is grown between trees. This is a frequent practice in tropical climates to prevent erosion. ↑ SOIL CONSERVATION

GB016 mulch (*v.t.*) To place cut grass, cut leaves or straw round the base of the stem of a plant and over the soil. This practice protects the soil from being baked by sunlight, and also the rotting of grass, leaves, or straw, provides nutrients for the growing plant. ↑ AGRICULTURE

GB017 fallow (*adj.*) Describes land left without crops; during this period the soil fertility improves and plant nutrients become replaced. The practice of leaving land fallow is also called **resting** the land □ *land is left to lie fallow* ↓ ARABLE · DOMESTICATED ↑ AGRICULTURE

GB018 arable (*adj.*) Describes land suitable for growing crops; it also describes a type of farming in which crops are grown. ↓ FALLOW

GB019 domesticated (*adj.*) An animal dependent on man for food and either working for him or providing him with meat or milk. ↑ FALLOW → WILD (Cn)

GB020 farming (*n.*) The practice of cultivating the land for crops, or of keeping animals for meat or for dairy products. —***farm*** (*n.*) ***farm*** (*v.*) ↓ DAIRY FARMING · STOCK[2] · POMOLOGY · GRAZE ↑ AGRICULTURE

GB021 dairy farming (*n.*) Keeping cattle or goats to obtain milk and to make dairy products from the milk. ↓ PASTURE · FODDER · HAY · MAINTENANCE RATION · PRODUCTION RATION · STRAW ↑ FARMING

GB022 pasture (*n.*) A piece of land with grass or other fodder crops for farm animals growing on it is pasture, *e.g.* cattle, goats, sheep, horses, and donkeys, graze on pasture □ *cattle are put out to pasture* ↑ DAIRY FARMING

GB023 fodder (*n.*) **1** Plants grown to feed domesticated animals. **2** The dried products of such plants, *e.g.* hay. ↑ DAIRY FARMING

GB024 hay (*n.*) Dried cut grass, stored and used as fodder. ↑ DAIRY FARMING

GB025 maintenance ration (*n.*) The quantity of fodder sufficient to keep a domesticated animal in good health. ↑ DAIRY FARMING

GB026 production ration (*n.*) The quantity of fodder, above the maintenance ration, that must be supplied to domesticated animals so that they can supply the product, such as meat, milk, or eggs, for which they are reared. ↑ DAIRY FARMING

GB027 straw (*n.*) Dry cut stalks of cereal plants, *e.g.* wheat straw, barley straw, rice straw; used as bedding for animals. ↑ DAIRY FARMING

GB028 stock[2] (*n.*) The progeny of a common ancestor, either plant or animal, the breeding of which is controlled by man; inbreeding gives rise to special characteristics, differentiating the stock from the rest of the species. A plant or animal stock is bred for its special characteristics, such as immunity from disease, prolific breeding, or tolerance of extreme climatic conditions. ↓ CLONE · RAMET ↑ FARMING → INBREEDING

GB029 clone (*n.*) A group of individuals propagated from a single sexual ancestor by asexual methods. In plants the descendants are reproduced by vegetative propagation or by apomixis. In animals the progeny are reproduced asexually or by parthenogenesis. All the individuals of a clone are genetically identical, apart from genetic variation arising as a result of spontaneous mutations. ↑ STOCK[2] → APOMIXIS · PARTHENOGENESIS

GB030 ramet (*n.*) An individual member of a clone. ↑ STOCK[2]

GB031 pomology (*n.*) The study of scientific methods of producing fruit. ↑ FARMING

GB032 graze (*v.i.*) (Of herbivorous, domesticated animals) to eat grass or other fodder crops □ *dairy cattle need to* graze on *good pasture* ↓ REAR ↑ FARMING

GB033 rear (*v.t.*) To breed and to care for domesticated animals. ↑ GRAZE

GB034 crop[1] (*n.*) The produce of plants grown on a large scale for the use of man, *e.g.* cereal, grains, fruit, legumes, seeds. The plants are grown in fields or in farms but not in gardens, *e.g.* mixed crops on a farm include maize, groundnuts and beans □ *a heavy crop of wheat; a light crop of maize* —CROP (*v.*) ↓ HOE · FURROW · MANURE · WEED[2] · TILL · CULTIVATED ↑ AGRICULTURE

GB035 hoe (*n.*) An implement for breaking up earth and removing weeds; it is a rectangular piece of iron set at right angles to or in line with a handle. —HOE (*v.*) ↓ PLOUGH (*n.*) HARROW (*n.*) ↑ CROP[1]

GB036 plough (*n.*) An implement drawn by animals or by a tractor which makes furrows in the soil by means of a long sharp metal blade. —PLOUGH (*v.*) ↑ HOE

GB037 harrow (*n.*) An implement which is dragged along the ground and pushes soil back into furrows to level the soil surface and cover seeds in the furrows. ↑ HOE

GB038 furrow (*n.*) A long, narrow hole in the ground (like a long groove). Seeds are sown in furrows. ↓ PLOUGHING · HARROWING · HOEING ↑ CROP[1]

GB039 ploughing (*n.*) The use of a plough to dig up soil by making furrows. Ploughing breaks up soil to a greater depth than hoeing; this allows plant roots to grow deeper. Furrows are usually ploughed in a straight line, but on hill slopes the furrows follow the contours; this is contour ploughing. ↑ FURROW

GB040 harrowing (*n.*) Using a harrow. ↑ FURROW

GB041 hoeing (*n.*) Using a hoe. ↑ FURROW

GB042 manure (*n.*) The faeces and excreta of animals when put on soil to make it more fertile. ↓ ARTIFICIAL MANURE · FERTILIZER · GREEN MANURE · COMPOST · DUNG · VERNALIZATION ↑ CROP[1]

GB043 artificial manure (*n.*) Any chemical substance, such as ammonium sulphate, sodium nitrate, or bone-meal, used to make a soil more fertile. ↑ MANURE

GB044 fertilizer (*n.*) Any manure or chemical substance (artifical manure) used to make the soil more fertile by replacing plant nutrients removed by crops. —***fertilize*** (*v.*) ↑ MANURE

GB045 green manure (*n.*) Leguminous plants ploughed into the soil; the rotting plants replace soil nutrients and make the soil more fertile. ↑ MANURE

GB046 compost (*n.*) Decayed plant remains, either from a natural process, or made to decay faster with the aid of chemical substances, such as lime; it is used as a fertilizer. ↑ MANURE

GB047 dung (*n.*) The faeces of large tetrapod vertebrates, *e.g.* cattle; a very important manure in agriculture. ↑ MANURE

GB048 vernalization (*n.*) A method of

inducing a plant to flower in a shorter time than it would under normal conditions. Some varieties of plants, especially cereals, have to be sown in autumn to produce flowers, and hence fruit, *i.e.* grain, in the summer of the next year; other varieties can be sown in spring and flower in summer. Vernalization is used with the varieties normally sown in autumn, as in cold climates severe frost may kill the seed. The seeds are moistened and allowed to start germination; when the tip of the radicle emerges, the seed is exposed to a low temperature (just above 0°C) for a few weeks. The vernalized seed is then stored, and can be sown in spring to flower in summer. Vernalization is also useful in growing crops in new areas where the summer season is shorter than that of the normal conditions for a crop. ↑ CROP[1]

GB049 weed[2] (*n.*) An undesirable wild plant adapted to live and reproduce rapidly under conditions of cultivation or pasture. ↓ PEST · PESTICIDE · HERBICIDE ↑ CROP[1] → WEED[1]

GB050 pest (*n.*) Any of the animals eating or destroying crops; pests usually are considered to be insects, but animals such as wild pigs or rabbits, which destroy crops, and birds eating seeds, are also pests. Pests include all species detrimental to man, such as tsetse flies. ↑ WEED[2]

GB051 pesticide (*n.*) Any chemical substance used for the destruction of a pest, or of pests; it is usually an insecticide. ↑ WEED[2]

GB052 herbicide (*n.*) Any chemical substance used to kill plants; generally used to kill weeds. —***herbicidal*** (*adj.*) ↑ WEED[2]

GB053 till (*v.t.*) To prepare land for crops; the process includes ploughing, harrowing and adding manure or fertilizers. ↓ SOW · TRANSPLANT · CULTIVATE ↑ CROP[1]

GB054 sow (*v.t.*) To plant or to scatter seeds over the ground, for the cultivation of a crop. —***sowing*** (*n.*) ↑ TILL

GB055 transplant (*v.t.*) **1** To remove a plant from one place and put it in another, *e.g.* ***a*** seedlings are removed from a pot and transplanted in soil; ***b*** young rice shoots are transplanted from a nursery to a padi field. **2** To transfer an organ or tissue from one part or from one individual to another. —***transplanting*** (*n.*) ↑ TILL

GB056 cultivate (*v.t.*) To prepare soil for crops; to grow crops on prepared land; the term implies the improvement of plants for the use of man. —***cultivation***, CULTIVATED (*adj.*) ***cultivator*** (*n.*) ↑ TILL

GB057 cultivated (*adj.*) **1** Describes a plant improved and grown by man for his use. **2** Describes land prepared for crops, or land on which crops are growing. ↑ FALLOW (An) · CROP[1] → WILD (I) · DOMESTICATED

GB058 vegetative propagation (*n.*) The use of vegetative or asexual reproduction in cultivation. The advantages of the method over using growth from seeds are, ***a*** it perpetuates special characteristics in a stock; ***b*** fruit or seeds may be obtained more quickly than when the same plant is grown from seed; ***c*** propagated plants are more robust than those grown from seed. Seedless plants can only be grown in this way. ↓ PRUNING · GRAFTING · SCION · CHIMAERA[1] · GRAFT[2] · AUTOPLASTIC ↑ AGRICULTURE · VEGETATIVE REPRODUCTION

GB059 pruning (*n.*) The cutting off of dead parts of a tree, or of various branches if growth is exuberant. Pruning causes more and better fruit to be borne in the next season. ↓ LAYERING · MARCOTTING · CUTTING · BUDDING[3] ↑ VEGETATIVE PROPAGATION

GB060 layering (*n.*) A method of propagation in which a branch or lateral stem of a plant is bent and part of it covered with earth in the ground; pegs are placed on either side to hold it in the ground. Adventitious roots grow at a node. The stem is then cut off and transplanted. —LAYER (*v.*) ↑ PRUNING → ADVENTITIOUS ROOT

GB061 marcotting (*n.*) A method of propagation in which a node on a branch, or lateral stem, is covered with earth and manure, and covered with cloth; it is kept moist, and eventually adventitious roots grow at the node. The stem is cut off and transplanted. ↑ PRUNING

GB062 cutting (*n.*) A piece of branch, or stem, containing at least one node, cut from the parent plant and transplanted. Some plant species will grow from a root cutting. ↑ PRUNING

GB063 budding[3] (*n.*) A method of propagation in which a dormant bud is cut from a scion; the bark of a stock is cut in a T-shape, and the bud placed underneath the bark in the cut; it is then covered with a waterproof covering. The bud forms a shoot if the tissues of scion and stock grow together. ↓ SCION · STOCK ↑ PRUNING

GB064 grafting (*n.*) A method of propagation by transplanting plant or animal tissues to induce them to join and to continue growing. The piece grafted is usually much smaller than the tissue to which it is joined. Grafting can be autoplastic, homoplastic, or heteroplastic. —GRAFT (*n.*) GRAFT (*v.*) ↓ GRAFT[1] · AUTOGRAFTING · HOMOGRAFTING · HETEROGRAFTING ↑ VEGETATIVE PROPAGATION · TRANSPLANT

GB065 graft[1] (*n.*) The small part of an organism that is grafted on the much larger part of another individual (or to a different position on the same individual). ↑ GRAFTING

GB066 autografting (*n.*) Alternative term for AUTOPLASTIC GRAFTING. ↓ AUTOPLASTIC

GB067 homografting (*n.*) Alternative term for HOMOPLASTIC GRAFTING. ↓ HOMOPLASTIC

GB068 heterografting (*n.*) Alternative term for HETEROPLASTIC GRAFTING. ↑ GRAFTING ↓ HETEROPLASTIC

GB069 scion (*n.*) **1** The graft of a plant; the portion grafted on the growing stem of a tree. The scion grows and bears seed or fruit, using the root and stem system onto which it has been grafted. **2** Any propagule of a plant planted in soil. ↓ STOCK[1] · DONOR[2] · HOST[2] · RECIPIENT[1] ↑ VEGETATIVE

PROPAGATION · GRAFTING → PROPAGULE

GB070 stock[1] (*n.*) The rooted stem of a tree on which a scion is grafted. ↑ SCION

GB071 donor[2] (*n.*) (In animals) the individual providing a graft. ↑ SCION · GRAFT[1]

GB072 host[2] (*n.*) (In animals) the individual receiving a graft. ↑ SCION · GRAFT[1]

GB073 recipient[1] (*n.*) Alternative term for host. ↑ SCION · HOST[2]

GB074 chimaera[1] (*n.*) The result of heteroplastic grafting of plants followed by association of the cells of scion and stock; it produces a plant of mixed characteristics of both scion and stock; this is a chimaera. ↓ CHIMERA · GRAFT HYBRID · HETEROPLASTIC ↑ VEGETATIVE PROPAGATION · SCION · STOCK[1]

GB075 chimera (*n.*) Alternative spelling for CHIMAERA.

GB076 graft hybrid (*n.*) Alternative term for CHIMAERA (↑).

GB077 graft[2] (*v.t.*) To perform the technique of grafting □ *a bud is grafted on a stem* ↑ VEGETATIVE PROPAGATION

GB078 autoplastic (*adj.*) Describes grafting in which tissue is removed from its normal position and grafted onto another place on the same individual. ↓ HOMOPLASTIC · HETEROPLASTIC ↑ VEGETATIVE PROPAGATION

GB079 homoplastic (*adj.*) Describes grafting in which tissue is removed from one individual and grafted onto a different individual of the same species. ↑ AUTOPLASTIC

GB080 heteroplastic (*adj.*) Describes grafting in which tissue is removed from one individual and grafted onto an individual of a different species. ↑ AUTOPLASTIC

Irritability

HA001 irritability (*n.*) **1** The fundamental disposition of all living organisms to respond to a change in their external environment by complex activity or by adaptation. **2** The disposition of living structures to respond to a change in conditions, *e.g.* ***a*** the change in pigmentation of a frog in different habitats (adaptation); ***b*** the downward growth of roots in response to gravity (complex activity); ***c*** the response of a man on touching a hot object (complex activity). —IRRITANT, IRRITATION (*n.*) IRRITABLE, IRRITANT, IRRITATIVE, IRRITATED (*adj.*) IRRITATE (*v.*) ↓ STIMULUS · IRRITATE · IRRITABLE · RESPONSE → NERVOUS SYSTEM · NEURAL ARC · SIGHT · HEARING · SMELL · TOUCH · NEUROLOGY · SENSITIVITY[1] (H)

HA002 stimulus (*n.*) A change in the environment of a living organism, or part of a living organism; the change is sufficiently intense to provoke a response by the organism, or part of it, without providing energy for the reaction, *e.g.* ***a*** the sight of food is a stimulus to an animal, or to the salivary glands of a mammal; ***b*** light acts as a stimulus to plants □ *the skin responds to the stimulus of touch; the stimulus of temperature provokes a response from Paramecium* —STIMULANT, STIMULATION (*n.*) STIMULATIVE, STIMULATED (*adj.*) STIMULATE (*v.*) ↓ IRRITATION · STIMULATION · IRRITANT[1] (Sn) · STIMULANT · MINIMAL STIMULUS · SUBLIMINAL STIMULUS · THRESHOLD STIMULUS ↑ IRRITABILITY

HA003 irritation (*n.*) The act of irritating; when A irritates B, B exhibits irritability. ↑ STIMULUS

HA004 stimulation (*n.*) The action or process that takes place when a living organism, or part of it, responds to a stimulus, *e.g.* the stimulation of saliva production in mammals by the perception of food. ↑ STIMULUS

HA005 irritant[1] (*n.*) If A irritates B, then A is an irritant to B and B exhibits irritability. An irritant is a specific stimulus under observation, *e.g.* an acid is an irritant to *Amoeba*, *i.e.* the acid causes a response by the *Amoeba*. ↑ STIMULUS

HA006 stimulant (*n.*) An agent having the effect of a stimulus, *e.g.* the force of gravity is a stimulant for the roots and stem of a plant. The roots and stem respond to the stimulus of gravity. Stimulant names the agent; stimulus implies causing a response. ↑ STIMULUS

HA007 minimal stimulus (*n.*) A stimulus with an intensity just sufficient to provoke a response. Also called a ***threshold stimulus.*** ↑ STIMULUS.

HA008 subliminal stimulus (*n.*) A stimulus with an intensity which is not sufficient to provoke a response, although a summation of subliminal stimuli does provoke a response. Also known as a ***subminimal stimulus.*** ↓ SUMMATION

HA009 threshold stimulus (*n.*) Alternative term for MINIMAL STIMULUS (↑).

HA010 irritate (*v.t.*) To cause a response from a living organism, *e.g.* ***a*** the sight of food irritates an animal; ***b*** the force of gravity irritates plant tissues. The focus is on the organism. ↓ STIMULATE ↑ IRRITABILITY

HA011 stimulate (*v.t.*) To cause a response by a living organism, or part of it, *e.g.* the sight of food (a stimulus) stimulates the salivary glands of a mammal (the response is salivation). The focus is on the stimulant. ↑ IRRITATE

HA012 irritable (*adj.*) Possessing the characteristic of irritability, *e.g.* all living things are irritable because they exhibit irritability. ↓ IRRITANT[2] · IRRITATED · STIMULATED · IRRITATIVE · STIMULATIVE ↑ IRRITABILITY

HA013 irritant[2] (*adj.*) Describes an object, substance, or organism that can cause irritation, *e.g.* the saliva of a mosquito contains an irritant substance. ↑ IRRITABLE

HA014 irritated (*adj.*) If A irritates B, then B is an irritated organism. A living organism is always *irritable* (its disposition), but it is only *irritated* when it reacts to its environment. ↑ IRRITABLE

HA015 stimulated (*adj.*) Describes a living organism, or part of it, when responding to a stimulus. ↑ IRRITABLE

HA016 irritative (*adj.*) Describes a process of irritation, *e.g.* temperatures above 25°C are irritative to *Paramecium.* ↑ IRRITABLE

HA017 stimulative (*adj.*) Describes an agent acting as a stimulant, *e.g.* food is stimulative to all animals. ↑ IRRITABLE

HA018 response (*n.*) A change in the rate or intensity of the activities of a living organism, or part of it; the start or the termination of such an activity. A response is provoked by a stimulus. To contrast **response** and **reaction, *a*** the response of an animal to an external stimulus, such as the sight of food, does not require the stimulus to provide energy for the response; the animal itself provides the energy for the response; ***b*** the physical reaction of an elastic string arises from the energy supplied by the stretching force □ *the organism acts in response to a stimulus —**respond*** (*v.*) ↓ SENSE · SENSE ORGAN · SENSORY ↑ IRRITABILITY

HA019 sense (*n.*) A method by which an animal perceives physical stimuli in its environment. The senses of vertebrates are sight, hearing, smell, taste and touch. —SENSATION, SENSIBILITY (*n.*) SENSITIVE, SENSORY, SENSILE (*adj.*) SENSE (*v.*) ↓ SENSATION · SENSIBILITY ↑ RESPONSE

HA020 sensation (*n.*) The whole process of perceiving a particular stimulus and interpreting the stimulus by means of the nervous system, *e.g.* the sensation of colour involves the sense of sight, and its interpretation by the central nervous system. The sensation of colour experienced by animals varies from one species to another, but they possess the sense of sight through similar types of receptors, *e.g.* ***a*** bees perceive different ranges of colour from those perceived by man; ***b*** some vertebrates have a poorer perception of colour than others, but all have the same mechanism for sight. ↑ SENSE

HA021 sensibility (*n.*) The disposition to respond to physical stimuli. A continuous reception of stimuli causes fatigue of the receptor, and lowers its sensibility, *e.g.* if ether is smelt for several minutes, the ability to perceive the smell disappears, *i.e.* the sensibility of the olfactory organ decreases ↑ SENSE

HA022 sense organ (*n.*) (In an animal) any special structure which perceives physical stimuli from the external or internal environment, *e.g.* the eye perceives light, the ear perceives sound, nerve endings in muscles perceive pressure. Each sense organ is sensitive to one particular stimulus, such as pressure, temperature, sound, chemical concentration, or light. When a minimal stimulus is perceived by its appropriate sense organ, the latter initiates impulses in the nervous system; these impulses cause a response □ *a sense organ is stimulated by a physical stimulus; a sense organ perceives a stimulus* ↓ RECEPTOR · SUMMATION · INHIBITION · RECIPROCAL INHIBITION · PERIPHERAL INHIBITION · CENTRAL INHIBITION · SENSORY ADAPTATION ↑ RESPONSE

HA023 receptor (*n.*) Alternative term for SENSE ORGAN. The term can be taken to refer to only that part of the nerve end which is stimulated and not to include the supporting tissues of a sense organ, *e.g.* the receptors are the cones and rods of the retina, while the sense organ is the whole eye □ *a receptor is stimulated by a physical stimulus* ↑ SENSE ORGAN → EFFECTOR[1] (Cn)

HA024 summation (*n.*) A process of addition of separate stimuli. The additive effect of separate impulses arriving at a neuron, or at an effector, to provoke a response; a response may not be provoked by any of the separate stimuli. The separation of impulses arriving at a neuron can be ***spatial*** or ***temporal.*** In spatial separation, the impulses arrive at different synapses connected to the same neuron or arrive at the same effector. In temporal separation, the impulses arrive successively at the same neuron, or the same effector. In vertebrates, temporal separation at a single neuron probably does not occur, owing to the refractory period of the nerve fibres causing an impulse to fade before the next one can arrive. Many spatially separated impulses may be summated in any one process. Summation is an important effect in the interaction and cooperation of neurons in a nervous system; it supplies the gradation of behaviour arising from the many environmental stimuli to which an organism is exposed. —***summate*** (*v.*) ↓ INHIBITION (Cn) ↑ SENSE ORGAN → NEURON

HA025 inhibition (*n.*) The suppression, partial or complete, of a response by a living organism, or part of it, as a result of separate impulses arriving at an effector. Inhibition can be either ***central, peripheral,*** or ***reciprocal.*** Inhibition is an important effect in the interaction of neurons in a nervous system; it completes the gradation of behaviour arising from summation. —INHIBITOR, INHIBITION (*n.*) ***inhibitory, inhibited*** (*adj.*) INHIBIT (*v.*) ↑ SENSE ORGAN · SUMMATION (Cn)

HA026 reciprocal inhibition (*n.*) The process in which the contraction of a muscle causes the relaxation of the antagonistic muscle by the inhibition of the motor neuron which normally stimulates the antagonistic muscle to preserve muscle tonus. ↑ SENSE ORGAN

HA027 peripheral inhibition (*n.*) (In vertebrates) inhibition which occurs in the

autonomic nervous system, *e.g.* a branch of the vagus nerve inhibits the beating of the heart. ↑ SENSE ORGAN → AUTONOMIC NERVOUS SYSTEM · VAGUS NERVE

HA028 central inhibition (*n.*) Inhibition which arises in the central nervous system, *e.g.* the suppression of a reflex action because of other stimuli. ↑ SENSE ORGAN → REFLEX ARC

HA029 sensory adaptation (*n.*) **1** The automatic change of a sense organ to external conditions, *e.g.* the adaptation of the aperture of the iris to the intensity of the light. **2** The change in excitability of a sense organ after continuous stimulation. With longer periods of stimulation a more intense stimulation is needed to produce a response, *e.g.* skin contact, if maintained, fails to excite the touch receptors, and a more intense stimulation is needed to effect a response. —ADAPT (*v.*) ***adapted*** (*adj.*) ↑ STIMULUS → EXCITABILITY

HA030 sensory (*adj.*) Of, or to do with, the reception of stimuli, *e.g.* ***a*** a sensory nerve conducts impulses from a receptor to the central nervous system; ***b*** a sensory neuron receives impulses from a receptor. ↓ SENSILE · SENSITIVE[1] ↑ RESPONSE · RECEPTOR → IMPULSE[1]

HA031 sensile (*adj.*) Describes any object, or substance, capable of stimulating the senses of an animal, *i.e.* it causes a taxis or a kinesis. ↑ SENSORY → TAXIS · KINESIS

HA032 sensitive[1] (*adj.*) Of or to do with the perception of, and the response to, a physical stimulus by a living organism, or part of it, *e.g.* ***a*** the human eye is sensitive to electro-magnetic waves between certain wave-lengths; ***b*** a receptor is *sensitive* to stimuli; its associated neurons are *sensory* because they conduct impulses from the receptor. —SENSITIVITY (*n.*) ↑ SENSORY

HA033 hypersensitive (*adj.*) Describes a much greater response than normal to a physical stimulus. —***hypersensitivity*** (*n.*) ↑ SENSORY

Nervous System

HB001 nervous system (*n.*) A mechanism by which an animal perceives its external environment and responds to it by coordinating its own activities with the events perceived. The structures consist of nervous tissue, with its supporting tissues, and the tissues function by the conduction and proliferation of nerve impulses. All metazoa, except sponges, have a nervous system. Unicellular organisms and plants do not possess a nervous system. ↓ NERVE NET · CENTRAL NERVOUS SYSTEM · INNERVATION · NERVE CENTRE · BRAIN · SPINAL CORD · HINDBRAIN · MID-BRAIN · FORE-BRAIN · CEREBRUM → IRRITABILITY

HB002 nerve net (*n.*) The simplest form of nervous system; it occurs in coelenterates. It consists of a network of polygonal nerve cells (not neurons) with fine processes which are not distinguishable as axons and dendrons. The network of nerve cells is spread diffusely through the tissues, but has no nerve centre for coordination of the whole network. The nerve-net connects with sensory cells in the endoderm and ectoderm, and with effectors, *e.g.* epitheliomuscular cells and nematocysts. The nerve cells and their processes conduct impulses slowly and in all directions, as the processes and their synapses are not unidirectional as in neurons. The extent of the effect of a stimulus depends on summation of the impulses. ↓ NERVE CORD · GANGLIONEURAL NERVOUS SYSTEM ↑ NERVOUS SYSTEM

HB003 nerve cord (*n.*) (In invertebrates) a solid, cord-like structure or strand of nervous tissue composed of numerous nerve fibres, running dorsally the length of the animal. Each segment of the animal usually contains one ganglion, or a ganglionic swelling, on the nerve cord. In Annelida and Arthropoda, the nerve cord consists of a double strand, each interconnected at the metameric ganglia, there being one ganglion in each segment; these two strands enter the one ganglion. ↑ NERVE NET → METAMERE · NERVE FIBRE

HB004 ganglioneural nervous system (*n.*) A nerve system consisting of ganglia joined together by nerve strands. Many of the ganglia are situated on a nerve cord, with the biggest ganglia at the anterior end. The behaviour pattern is mainly reflex action, with the anterior ganglia exercising some control over other ganglia, *e.g.* as in arthropods. ↑ NERVE NET → GANGLION

HB005 central nervous system (*n.*) In coelomates, the system consists of a nerve cord situated along the length of the animal, swollen at the anterior end to form a nerve centre for coordination. The nerve cord contains neurons, the fibres of which form peripheral nerves, both sensory and motor. Higher and lower types of animals are differentiated by the development of the nerve cord and brain, *e.g.* the earthworm has a simple nerve cord with a pair of anterior swellings (ganglia) serving as a rudimentary brain; such a system is called ganglioneural. In vertebrates, the central nervous system consists of a spinal cord and a brain. ↓ PERIPHERAL NERVOUS SYSTEM (N.S.) · SOMATIC PERIPHERAL N.S. · VISCERAL

PERIPHERAL N.S. · AUTONOMIC N.S. · SYMPATHETIC N.S. · PARASYMPATHETIC N.S. ↑ NERVOUS SYSTEM

HB006 peripheral nervous system (*n.*) Contains all the nerves of a nervous system apart from the central nervous system; it consists of nerves running to and coming from the central nervous system and connecting with the receptors, glands, and muscles in the body. In invertebrates, the peripheral nerves originate in ganglia on the nerve cord. In vertebrates, the peripheral nerves are, *a* cranial nerves originating in the brain; *b* spinal nerves originating in the spinal cord; *c* postganglionic nerves originating in autonomic ganglia. Those originating from the central nervous system form the somatic peripheral system, and those originating in the autonomic ganglia form the visceral peripheral system. ↑ CENTRAL NERVOUS SYSTEM

HB007 somatic peripheral nervous system (*n.*) Consists of nerves formed from nerve fibres which are continuous, without synapses from the central nervous system to either receptors or effectors. The nerves in the system are almost entirely mixed nerves, but the sensory and motor fibres do not interact except at synapses in the central nervous system. A reflex arc occurs in the somatic system. In vertebrates, the longer somatic peripheral nerves branch repeatedly after leaving the central nervous system; in man, a long peripheral nerve may have a diameter up to 1 μm, and end in 100 000 branches. ↑ CENTRAL NERVOUS SYSTEM → REFLEX ARC

HB008 visceral peripheral nervous system (*n.*) Consists of a network of nerves and ganglia, some closely associated in a nervous plexus. The nervous pathway between the central nervous system and the effector is not continuous, but passes through ganglia and plexuses. Synapses are situated in each ganglion and plexus, so that various levels of coordination exist for any motor impulse. The final motor nerve is short and usually leads from a synapse on or near to the organ to be activated. The visceral peripheral nervous system is under the control of the autonomic nervous system. ↑ CENTRAL NERVOUS SYSTEM → NERVOUS PLEXUS

HB009 autonomic nervous system (*n.*) A nervous system independent of outside stimuli, dependent on internal stimuli; it activates the important visceral functions more or less automatically. A simple autonomic system is found in some invertebrates, such as arthropods; it consists of ganglia which have sensory and motor nerves connected to the gut. In vertebrates, the autonomic system is well developed. It supplies motor nerves to the glands and to smooth muscle of the viscera. The characteristic feature of the autonomic system is that nerve fibres do not run uninterrupted from the central nervous system to effectors, but instead form synapses in autonomic ganglia. Motor nerves from these ganglia connect with effectors. The autonomic system is divided into the sympathetic and parasympathetic systems. The sympathetic system is larger than the parasympathetic system; it supplies the skin and the limbs; the parasympathetic system does not. The coordination of the autonomic system is mainly carried out in the hypothalamus, medulla, and spinal cord. ↑ CENTRAL NERVOUS SYSTEM

HB010 sympathetic nervous system (*n.*) In vertebrates, such as mammals and birds, but uncertain in other vertebrates, preganglionic fibres of this sytem leave the spinal cord in the thoracic and lumbar region through the ventral root of a spinal nerve and connect with sympathetic ganglia. The sympathetic ganglia are located in pairs on two sympathetic trunks. Afferent nerves lead from the sympathetic ganglia to various nervous plexuses. From each plexus motor nerves connect with glands and visceral organs. The sympathetic system is concerned with preparing the animal for times of emergency, *i.e.* for fight or flight, or other violent actions to avoid abnormal conditions. The sympathetic system is in opposition to the parasympathetic nervous system, *e.g.* impulses from the sympathetic system increase the rate and strength of heart beat (preparing for violent action); the impulses from the parasympathetic system lower the rate and strength of heart beat, thus returning the heart beat to normal. ↑ CENTRAL NERVOUS SYSTEM

HB011 parasympathetic nervous system (*n.*) In vertebrates, preganglionic nerves of this system leave the central nervous system, *a* as cranial nerves, particularly the vagus nerve; *b* through the ventral root of spinal nerves in the sacral region, and connect with post-ganglionic nerves. The postganglionic nerves have their cell bodies (cytons) scattered amongst the visceral organs and glands, or in ganglia near the visceral organs and glands. The parasympathetic system is concerned with restoring the normal functioning of visceral organs and glands. Most of the glands, visceral organs, and their muscles, are connected to both the sympathetic and parasympathetic systems, *e.g.* parasympathetic nerves initiate peristalsis in the gut; sympathetic nerves relax the muscles and inhibit peristalsis. The parasympathetic system has no connection with the skin and limbs, unlike the sympathetic system, which does connect with these parts. ↑ CENTRAL NERVOUS SYSTEM → VAGUS NERVE

HB012 innervation (*n.*) The distribution and type of nerves in an organism. ↓ SENSORY NEURON · SENSORY NERVE · PERIPHERAL NERVE · GIANT NERVE FIBRE · OLFACTORY NERVE ↑ NERVOUS SYSTEM

HB013 sensory neuron (*n.*) A neuron with a nerve fibre connected to a receptor, and with at least one nerve fibre connected to the central nervous system. The receptor

initiates impulses which are conducted by the neuron to the central nervous system. In vertebrates, the cell-body (cyton) is situated in the dorsal root ganglion; the neuron is a pseudo-unipolar cell, with the dendron connected to the receptor and the axon connected to a synapse in the spinal cord. The cyton has no dendrites, and no interconnection between neurons exists in the dorsal root ganglion. In invertebrates, the cyton is situated near the receptor, *i.e.* at the peripheral end of the neuron, and the long axon of the neuron connects with the central nervous system. ↓ ASSOCIATION NEURON · INTERNUNCIAL NEURON · MOTOR NEURON · NERVE ENDING · SENSORY NERVE ↑ INNERVATION

HB014 association neuron (*n.*) A neuron which is connected to a sensory neuron by a synapse and to a motor neuron by a synapse. Dendrons of an association neuron are connected synaptically to the axon of a sensory neuron; the axon of the association neuron is connected synaptically to dendrons of motor neurons. The pathway between sensory and motor neurons can consist of one or more association neurons. An association neuron is a multipolar cell with the cell-body (cyton) in the dorsal horn of the spinal cord. ↑ SENSORY NEURON

HB015 internuncial neuron (*n.*) Alternative term for an ASSOCIATION NEURON.

HB016 motor neuron (*n.*) A neuron whose axon connects with an effector; it conducts impulses from the central nervous system to the effector. The neuron stimulates the effector into activity. The part activated is a muscle or a gland. The cell body (cyton) of the neuron is in the ventral horn of the spinal cord for effectors in striped muscle, or in ganglia for effectors of smooth muscle and glands. ↓ MOTOR NERVE ↑ SENSORY NEURON

HB017 nerve ending (*n.*) The input region of a sensory neuron or the output region of a motor neuron. Nerve endings are the points where the nerve fibre is in contact with a sensory receptor or a motor end-plate. ↑ SENSORY NEURON

HB018 sensory nerve (*n.*) A peripheral nerve consisting of nerve fibres of sensory neurons; it conducts impulses, initiated by receptors, to the central nervous system. ↓ AFFERENT NERVE · MOTOR NERVE · EFFERENT NERVE · MIXED NERVE · CRANIAL NERVE · SPINAL NERVE · NERVE ROOT ↑ INNERVATION · SENSORY NEURON

HB019 afferent nerve (*n.*) Alternative term for SENSORY NERVE.

HB020 motor nerve (*n.*) A peripheral nerve consisting of nerve fibres of motor neurons; it conducts impulses from the central nervous system to various effectors. ↑ SENSORY NERVE · MOTOR NEURON

HB021 efferent nerve (*n.*) An alternative term for a MOTOR NERVE. ↑ SENSORY NERVE

HB022 mixed nerve (*n.*) A peripheral nerve containing nerve fibres of both sensory and motor nerves; there is no connection between the sensory and motor impulses in a mixed nerve.

HB023 cranial nerve (*n.*) (In vertebrates) a peripheral nerve arising in the brain and leaving the brain through a foramen in the skull. The nerve arises in the brain as two roots, one dorsal, one ventral, but the roots do not join as in spinal nerves; both roots form mixed nerves. Vertebrates possess 10, 11, or 12, cranial nerves mainly concerned with, *a* vision (optic); *b* hearing (auditory); *c* smelling (olfactory). In addition there are sensory and motor nerves connected to the face and jaws. ↓ OLFACTORY NERVE ↑ SENSORY NERVE

HB024 spinal nerve (*n.*) (In vertebrates) one of a pair of peripheral nerves arising as roots in the spinal cord. There are 31 pairs of spinal nerves in man, each pair leaving the vertebral column through an intervertebral foramen on either side of the vertebral column. A spinal nerve has two roots, one dorsal, one ventral, which join to form a mixed nerve, before passing through the intervertebral foramen. ↑ SENSORY NERVE → SPINAL CORD

HB025 nerve root (*n.*) (In vertebrates) the starting point of a spinal nerve or a cranial nerve; the roots are in the spinal cord and brain respectively; each nerve has two roots, one dorsal, one ventral. The dorsal root of a spinal nerve contains sensory nerve fibres and the ventral root contains motor nerve fibres. The dorsal root of a cranial nerve contains sensory nerve fibres, but also contains numerous motor nerve fibres; the ventral root contains motor nerve fibres and some sensory nerve fibres. Nerve roots are a characteristic feature of all vertebrates. ↑ SENSORY NERVE → SPINAL CORD

HB026 peripheral nerve (*n.*) A nerve in the peripheral nervous system. In the somatic peripheral system it is medullated; in the visceral peripheral system it is non-medullated. ↓ PREGANGLIONIC NERVE · POSTGANGLIONIC NERVE · RAMI COMMUNICANS ↑ INNERVATION · PERIPHERAL NERVOUS SYSTEM

HB027 preganglionic nerve (*n.*) A nerve which leaves the spinal cord through a ventral horn and enters a sympathetic ganglion on the sympathetic trunk, or passes through such a ganglion and enters an autonomic ganglion in a nervous plexus. It is medullated and originates in the thoracic, lumbar, or sacral, region of the spinal cord. It connects with a postganglionic nerve in a sympathetic or autonomic ganglion. Each preganglionic nerve is synaptically connected with many postganglionic nerves. ↑ PERIPHERAL NERVE · AUTONOMIC NERVOUS SYSTEM

HB028 postganglionic nerve (*n.*) A nerve, usually non-medullated, which connects an autonomic ganglion with an effector, either a visceral organ or a gland. The cell body (cyton) is situated in the ganglion or in the effector. ↑ PERIPHERAL NERVE

HB029 rami communicans (*n.pl., sing.* **ramus communicans**) Nerve fibres connecting the ventral root of spinal nerves with sympathetic ganglia. ↑ PERIPHERAL NERVE · AUTONOMIC NERVOUS SYSTEM → SPINAL CORD

HB030 giant nerve fibre (*n.*) (In some invertebrates) a nerve fibre up to 1 mm in diameter. A giant nerve fibre runs longitudinally through the ventral nerve cord; it conducts impulses much more rapidly than the nerve fibres in the nerve cord; its function is to help rapid coordination of body movements. Also called ***giant fibre***. ↓ NEUROCHORD · LATERAL NERVE ↑ INNERVATION · NERVE CORD

HB031 neurochord (*n.*) Alternative term for GIANT NERVE FIBRE (↑).

HB032 lateral nerve (*n.*) (In segmented invertebrates) a nerve branching off a nerve cord, and connecting with peripheral sensory cells or peripheral muscles. A lateral nerve occurs in, and is confined to, one segment of the animal. ↑ GIANT NERVE FIBRE

HB033 olfactory nerve (*n.*) The first cranial nerve; it is connected to the mucous membrane of the nose and is stimulated by odours; it is the sensory nerve of smell. ↓ OPTIC NERVE · OCULOMOTOR NERVE · TROCHLEAR NERVE · TRIGEMINAL NERVE · ABDUCENS NERVE · FACIAL NERVE · ACOUSTIC NERVE · GLOSSOPHARYNGEAL NERVE · VAGUS NERVE · ACCESSORY NERVE · HYPOGLOSSAL NERVE · SPINAL ACCESSORY NERVE · ACCESSORIUS NERVE · AUDITORY NERVE ↑ INNERVATION · SENSORY NERVE · CENTRAL NERVOUS SYSTEM → NOSE

HB034 optic nerve (*n.*) The second cranial nerve; it is connected to the retina and stimulated by light: the sensory nerve of sight. ↑ OLFACTORY NERVE → OPTIC CHIASMA · RETINA

HB035 oculomotor nerve (*n.*) The third cranial nerve; it is connected to four of the extrinsic muscles of the eye and is connected by nerve fibres of the parasympathetic system to the intrinsic muscles, *i.e.* the sphincter muscle of the iris and to the ciliary muscle; it is motor nerve of the muscles of the eyeball. ↑ OLFACTORY NERVE → EYEBALL

HB036 trochlear nerve (*n.*) The 4th cranial nerve; it is connected to the superior oblique muscle of the eye (an extrinsic muscle); a motor nerve of the eyeball. ↑ OLFACTORY NERVE → EYEBALL

HB037 trigeminal nerve (*n.*) The 5th cranial nerve; it is connected to the skin of the face, the teeth, and the mucous membrane of the mouth and jaw muscles; it is mainly a sensory nerve, but with motor fibres for muscles of mastication. ↑ OLFACTORY NERVE → MASTICATE

HB038 abducens nerve (*n.*) The 6th cranial nerve; it is connected to the lateral rectus muscle of the eyeball; a motor nerve of the eyeball. ↑ OLFACTORY NERVE → EYEBALL

HB039 facial nerve (*n.*) The 7th cranial nerve; it is connected, in mammals, to the superficial muscles of the face, to the salivary glands, to the taste buds of the front of the tongue, and to the lachrymal gland; it is a mixed sensory and motor nerve in mammals. ↑ OLFACTORY NERVE → MASTICATE · TASTE BUD · EYE

HB040 acoustic nerve (*n.*) The 8th cranial nerve; it is connected to the inner ear. One branch, the vestibular nerve, is connected to the semicircular canals, utriculus and sacculus; this is a sensory nerve for kinaesthetic sense. The other branch connects with the cochlea; this is stimulated by sound; it is the sensory nerve of hearing. ↑ OLFACTORY NERVE → INNER EAR

HB041 glossopharyngeal nerve (*n.*) The 9th cranial nerve; it is connected to the gills of fishes, in other vertebrates to the taste buds on the posterior portion of the tongue and to the muscles and membranes of the pharynx; it is concerned with the sensory and motor effects of swallowing. ↑ OLFACTORY NERVE → TASTE BUD · SWALLOW

HB042 vagus nerve (*n.*) The 10th cranial nerve; it is connected to the muscles of the pharynx, larynx, oesophagus, stomach, heart, and glands, in the thoracic and visceral cavities of mammals and to the gills of fishes. These are motor nerve fibres. Sensory nerve fibres connect with lungs, heart, and viscera in mammals, and the lateral line in fishes. The vagus is one of the longest nerves in the vertebrate body; in mammals, most of its branches form part of the parasympathetic system. ↑ OLFACTORY NERVE · PARASYMPATHETIC NERVOUS SYSTEM

HB043 accessory nerve (*n.*) The 11th cranial nerve, only present in mammals, in other vertebrates it is a branch of the vagus nerve; it is connected to the muscles of the pharynx and larynx and the muscles of the neck; it is a motor nerve for movements in the neck region. ↑ OLFACTORY NERVE

HB044 hypoglossal nerve (*n.*) The 12th cranial nerve in amniotes; in other vertebrates, it originates in the spinal cord. It is connected to muscles of the tongue in mammals; in other vertebrates it is connected to muscles below the pharynx. It is a motor nerve for tongue movements, and assisting in swallowing. ↑ OLFACTORY NERVE → SWALLOW

HB045 spinal accessory nerve (*n.*) Alternative term for ACCESSORY NERVE (↑).

HB046 accessorius nerve (*n.*) Alternative term for ACCESSORY NERVE (↑).

HB047 auditory nerve (*n.*) Alternative term for ACOUSTIC NERVE (↑).

HB048 nerve centre (*n.*) Any part of a nervous system where impulses from receptors are transformed into impulses to effectors. This can be part of the central nervous system or it can be a ganglion. Different levels of control are exercised by different nerve centres, some being at low levels, controlled by others at higher levels. ↓ GANGLION · NERVOUS PLEXUS ↑ NERVOUS SYSTEM · INNERVATION

HB049 ganglion (*n.,pl.* **ganglia**) A solid mass of nervous tissue in the shape of a

swelling or a bulb on nerve cords or on nerves. It consists of numerous cell bodies (cytons) of neurons. In invertebrates, a ganglioneural nervous system contains ganglia with synapses connecting the neurons; the ganglia are situated metamerically and each ganglion exercises local control in its own segment. In vertebrates, there are cerebrospinal ganglia and autonomic ganglia. —***ganglionation*** (*n.*) GANGLIONATED, GANGLIONIC, PREGANGLIONIC, POSTGANGLIONIC (*adj.*) ↓ CEREBROSPINAL GANGLION · AUTONOMIC GANGLION · SYMPATHETIC GANGLION · SYMPATHETIC TRUNK ↑ NERVE CENTRE · NERVE CORD

HB050 cerebrospinal ganglion (*n.*) Cerebral ganglia occur in the brain; they are a mass of cell bodies (cytons) forming grey matter. Spinal ganglia are located on the dorsal root of spinal nerves. They consist of a mass of cytons, surrounded by an envelope of connective tissue. There are no synaptic connections between neurons in spinal ganglia; all the neurons are pseudounipolar. ↑ GANGLION → SPINAL NERVE

HB051 autonomic ganglion (*n.*) A ganglion occurring in the autonomic nervous system; it consists of a mass of cell bodies (cytons) surrounded by a capsule of connective tissue. The axons entering the ganglion ramify among the cytons; all the neurons are multipolar. Synaptic connections between neurons are formed in autonomic ganglia. ↑ GANGLION · AUTONOMIC NERVOUS SYSTEM

HB052 sympathetic ganglion (*n.,pl.* **sympathetic ganglia**) A pair of sympathetic ganglia are associated with each pair of spinal nerves. Each ganglion is connected to the ventral root of a spinal nerve in the spinal cord by a nerve called the ramus communicans; some ganglia are connected by several rami communicans to the spinal cord. The ganglia are situated on two sympathetic trunks of nerve fibres, one on each trunk. The ganglia relay impulses to nervous plexuses, *e.g* the solar plexus, and act as nerve centres. ↓ NERVOUS PLEXUS ↑ GANGLION

HB053 sympathetic trunk (*n.*) A strand of nerve fibres connecting sympathetic ganglia. There are two sympathetic trunks, each ventral to the vertebral column, and on either side of it. ↑ GANGLION · AUTONOMIC NERVOUS SYSTEM

HB054 ganglia (*n.pl.*) See GANGLION (↑).

HB055 nervous plexus (*n.*) A network of nerves and ganglia. Impulses arrive from preganglionic nerves and leave by postganglionic nerves to effectors in the viscera. Each plexus is connected to several visceral organs, usually organs which have to be coordinated in their activities, *e.g.* the liver and the kidneys, so that nervous coordination can be carried out at the low level of a plexus. The ganglia in the plexuses form a median row in the body of a mammal, or bird, ventral to the sympathetic ganglia. ↑ GANGLION

HB056 solar plexus (*n.*) A nervous plexus situated posterior to the stomach; it is part of the sympathetic nervous system and supplies nerves to the abdominal viscera. ↑ NERVOUS PLEXUS

HB057 ganglionated (*adj.*) **1** Describes any swelling on a nerve or nerve cord which indicates the presence of cell bodies (cytons) among the nerve fibres, *e.g.* the nerve cord of an earthworm swells slightly in the middle of each segment; the nerve cord is ganglionated. **2** Describes any nerve on which one or more ganglia are situated. ↓ GANGLIONIC · PREGANGLIONIC · POSTGANGLIONIC ↑ NERVE CENTRE

HB058 ganglionic (*adj.*) Of, to do with, or shaped like, a ganglion, *e.g.* ganglionic synapses are synapses *in* ganglia. ↑ GANGLIONATED

HB059 preganglionic (*adj.*) Leading into a ganglion. A preganglionic nerve conducts impulses *to* the ganglion. ↑ GANGLIONATED

HB060 postganglionic (*adj.*) Leading away from a ganglion. A postganglionic nerve conducts impulses *from* the ganglion. ↑ GANGLIONATED

HB061 brain (*n.*) The coordinating centre of an animal's nervous system, occurring in various degrees of development at the anterior end of all bilateral animals. Animals without well-defined heads, *e.g.* radially symmetrical animals, such as coelenterates and echinoderms, do not have a nerve centre for coordination. In invertebrates, cerebral ganglia at the anterior end of the nerve cord act as a primitive brain. There are usually two cerebral ganglia, connected to one or to each one of two nerve cords; the ganglia are connected by a commissure. In vertebrates, the neural tube has three regions of expansion at the anterior end; these develop into the three primary brain vesicles: the fore-brain, the most anterior; the mid-brain, the next; and the hind-brain, the posterior vesicle. Both the fore-brain and the hind-brain become divided and form two secondary vesicles. The adult brain is derived from these five vesicles, four secondary and one primary ↓ NEURAL PLATE[1] · ENCEPHALON · BRAIN STEM · COMMISSURE · NEUROCOEL · MENINGES · CEREBRAL ↑ NERVOUS SYSTEM · NERVE CENTRE

HB062 neural plate[1] (*n.*) The earliest rudiment of nervous tissue in a vertebrate embryo. From it develop the neural fold, neural groove and neural tube. ↓ NEURAL FOLD · NEURAL GROOVE · NEURAL TUBE ↑ BRAIN

HB063 neural fold (*n.*) One of two raised ridges formed from ectoderm on the neural plate; the neural groove develops from the neural folds. ↑ NEURAL PLATE[1]

HB064 neural groove (*n.*) A groove formed by the two neural ridges of an embryo; it gradually deepens during embryonic growth and as the neural folds meet above it, it develops into the neural tube. ↑ NEURAL PLATE[1]

HB065 neural tube (*n.*) The longitudinal

tube formed in vertebrate embryos by development of the neural plate. It becomes expanded at the anterior end; this expansion develops into the vertebrate brain. The remaining posterior part develops into the spinal cord. The neural tube is the embryonic central nervous system; it is filled with cerebrospinal fluid. ↑ NEURAL PLATE[1]

HB066 encephalon (*n.*) The anatomical term for the brain. —***encephalic, encephaloid*** (*adj.*) ↓ PROSENCEPHALON · MESENCEPHALON · RHOMBENCEPHALON · TELENCEPHALON · DIENCEPHALON · METENCEPHALON · MYELENCEPHALON ↑ BRAIN

HB067 prosencephalon (*n.*) The primary fore-brain in a vertebrate embryo; it divides to form two secondary vesicles. ↑ ENCEPHALON

HB068 mesencephalon (*n.*) The primary mid-brain of a vertebrate embryo; this vesicle does not divide into secondary vesicles. ↑ ENCEPHALON

HB069 rhombencephalon (*n.*) The primary hind-brain of a vertebrate embryo; this divides to form two secondary vesicles. ↑ ENCEPHALON

HB070 telencephalon (*n.*) A secondary vesicle formed from the prosencephalon; it is the anterior part of the fore-brain and gives rise to the cerebral hemispheres and optic lobes, or bulbs. ↑ ENCEPHALON

HB071 diencephalon (*n.*)A secondary vesicle formed from the prosencephalon; it is the posterior part of the fore-brain and gives rise to the thalami. It surrounds the third ventricle of the brain. In lower vertebrates it is mainly concerned with vision and the maintenance of equilibrium. It consists of the thalamus (or the optic thalami), the epithalamus, hypothalamus, and pituitary gland. ↑ ENCEPHALON

HB072 metencephalon (*n.*) A secondary vesicle formed from the rhombencephalon; it is the anterior part of the hind-brain and gives rise to the cerebellum. ↑ ENCEPHALON

HB073 myelencephalon (*n.*) A secondary vesicle formed from the rhombencephalon; it is the posterior part of the hind-brain and gives rise to the medulla oblongata. ↑ ENCEPHALON

HB074 brain stem (*n.*) The main axis of the brain; it is a continuation of the spinal cord, swollen into three primary vesicles with outgrowths at different points. It ends blindly at the anterior end. The brain stem is one of the three main parts of the brain, the other two being the cerebellum and the cerebrum, both of which are outgrowths from the brain stem. The brain stem includes the medulla oblongata, the pons varolii, the mesencephalon and the diencephalon. ↓ GREY MATTER · WHITE MATTER ↑ BRAIN

HB075 grey matter (*n.*) Nervous tissue of vertebrates found in the central nervous system; it contains numerous cell bodies (cytons), dendrites, synapses, terminal processes of axons, blood vessels and neuroglia. It is internal to white matter in the spinal cord and some parts of the brain; it is external to white matter in the cerebral hemispheres and in the cerebellum of the higher vertebrates. Coordination in the central nervous system is effected in grey matter. Brain nuclei and nerve centres are composed of grey matter. ↑ BRAIN STEM

HB076 white matter (*n.*) Nervous tissue of vertebrates found in the central nervous system; it consists of tracts of medullated nerve fibres in the brain and spinal cord; it also contains blood vessels and neuroglia. It is mainly external to grey matter, but is internal to grey matter in the cerebral hemispheres and in the cerebellum of the higher vertebrates. The medullated fibres give the tissue its shiny white appearance. ↑ BRAIN STEM

HB077 commissure (*n.*) A band of nervous tissue. **1** (In arthropods and annelids) a transverse bundle of nerve fibres connecting each pair of ganglia in a metamere, or segment, the ganglia being situated one on each of the pair of nerve cords. **2** (In molluscs) a bundle of nerve fibres connecting ganglia. **3** (In vertebrates) bands of nerve fibres connecting left and right sides of various parts of the brain and of the spinal cord; it contains tracts which connect various nuclei in the brain, or connect different spinal levels. ↓ TRACT[2] · NUCLEUS[2] ↑ NERVE CORD · GANGLION · BRAIN

HB078 tract[2] (*n.*) A bundle of nerve fibres with each fibre starting from and ending at similar connections in the central nervous system. In the brain, the tracts connect various nuclei of the brain. In the spinal cord, there are six tracts; two are respectively afferent and efferent from a spinal level to the brain; two are respectively afferent and efferent to a higher spinal level; two are respectively afferent and efferent to a lower level. ↑ COMMISSURE

HB079 nucleus[2] (*n.,pl.* **nuclei**) A spatially defined mass of cell-bodies (cytons) in the vertebrate brain, connected with each other by tracts of nerve fibres. The nuclei are distinguished anatomically and consist of grey matter but their physiological function is not certain. Contrast **nerve centres**, which are physiological units with particular functions. ↑ NERVE CENTRE · COMMISSURE

HB080 neurocoel (*n.*) The system of interconnecting cavities in the central nervous system; it consists of the central canal in the spinal cord, the four main ventricles in the brain (two lateral ventricles and the third and fourth ventricle) and the connective channels in the brain. All the cavities are filled with cerebrospinal fluid. ↓ CEREBROSPINAL FLUID · CHOROID PLEXUS · CHORIOID PLEXUS · VENTRICLE[2] ↑ BRAIN

HB081 cerebrospinal fluid (*n.*) (In vertebrates) the clear liquid which fills the cavities of the brain and spinal cord and the spaces between the arachnoid and pia mater The fluid moves in a slow current down the central canal and up the spinal meninges; the ventricles in the brain

communicate with the cerebral meninges by holes in the roof of the hind-brain. The fluid is secreted continuously by choroid plexuses and absorbed by the veins of the surface of the brain. It is a solution of blood solutes of low molar mass, such as glucose, sodium chloride, etc., but not of the same concentration as in the blood. It contains little or no protein and very few cells. Its function is to nourish the nervous tissue, and to act as a buffer against shock to the nervous tissue. The total quantity of cerebrospinal fluid in man is about 100 cm^3. ↑ NEUROCOEL

HB082 choroid plexus (*n.*) (In vertebrates) a delicate, comb-like outgrowth of non-nervous epithelial tissue from the roof of a ventricle in the brain, constituting the ventricle roof in some regions. It encloses tufts of blood vessels and secretes cerebrospinal fluid continuously. In man, there is a choroid plexus in each of the four ventricles. ↑ NEUROCOEL

HB083 chorioid plexus (*n.*) Alternative term for CHOROID PLEXUS.

HB084 ventricle[2] (*n.*) (In vertebrates) a cavity in the brain; it is filled with cerebrospinal fluid. The ventricles in the brain are interconnecting and communicate with the central canal in the spinal cord. In man, there are two lateral ventricles in the cerebral hemispheres, one in the rest of the forebrain and one in the medulla oblongata. ↑ BRAIN

HB085 meninges (*n.pl.*) The collective term for the membranes covering the central nervous system of vertebrates; it consists of the dura mater, pia mater, and arachnoid or arachnoid membrane. —***meningeal*** (*adj.*) ↓ DURA MATER · PIA MATER · ARACHNOID · MENINGITIS ↑ BRAIN

HB086 dura mater (*n.*) A tough, outer membrane covering the brain and spinal cord of vertebrates; it is composed of connective tissue and contains blood vessels. ↑ MENINGES

HB087 pia mater (*n.*) A delicate, sheath-like, innermost membrane covering the brain and spinal cord of vertebrates; it contains many blood and lymph vessels. ↑ MENINGES

HB088 arachnoid (*n.*) A delicate inner membrane covering the brain and spinal cord, situated between the dura mater and the pia mater; it is separated from the pia mater by spaces filled with cerebrospinal fluid and is in contact with the dura mater. It contains many blood vessels. ↑ MENINGES

HB089 meningitis (*n.*) Inflammation of the meninges. ↑ MENINGES

HB090 cerebral (*adj.*) Of or to do with the brain of vertebrates, *e.g.* cerebral haemorrhage (bleeding from the blood vessels of the brain). ↓ CEREBROSPINAL ↑ BRAIN

HB091 cerebrospinal (*adj.*) (Of vertebrates) of or to do with the brain and spinal cord, *e.g.* the meninges are cerebrospinal membranes found ensheathing both the brain and the spinal cord. ↑ CEREBRAL

HB092 spinal cord (*n.*) (In vertebrates) a long, thick-walled tube of nervous tissue containing numerous cell bodies (cytons) and bundles of nerve fibres. The walls are of uneven thickness. It consists of grey matter which is H-shaped, forming four horns, surrounded by white matter. The grey matter surrounds a central canal. A narrow dorsal fissure and a wider ventral fissure run the length of the spinal cord. The spinal cord is enclosed by the meninges. Pairs of spinal nerves leave the spinal cord at different levels. ↓ VENTRAL HORN · NEURAL CANAL · MULTIPLE SCLEROSIS ↑ NERVOUS SYSTEM · MENINGES · SPINAL NERVE

HB093 ventral horn (*n.*) A projection of grey matter into the surrounding white matter of the spinal cord; it forms one limb of the H-shaped grey matter. There are two ventral horns. The ventral root of a spinal nerve enters one of the two ventral horns. In human anatomy, ventral horns are also known as ***anterior horns.*** ↓ ANTERIOR HORN · DORSAL HORN · POSTERIOR HORN · VENTRAL FISSURE · DORSAL FISSURE · CENTRAL CANAL ↑ GREY MATTER · SPINAL CORD · NERVE ROOT

HB094 anterior horn (*n.*) Alternative term for VENTRAL HORN.

HB095 dorsal horn (*n.*) A projection of grey matter corresponding to a ventral horn. The dorsal root of a spinal nerve enters a dorsal horn. There are two dorsal horns. In human anatomy, dorsal horns are also known as ***posterior horns.*** ↑ VENTRAL HORN

HB096 posterior horn (*n.*) Alternative term for DORSAL HORN.

HB097 ventral fissure (*n.*) A long deep groove on the ventral side of the spinal cord, running the length of the spinal cord. It is broader than the dorsal fissure; it is lined by the pia mater and contains blood and lymph vessels for nourishing the nervous tissue. ↑ VENTRAL HORN · PIA MATER

HB098 dorsal fissure (*n.*) A narrow, long, fairly deep groove in the dorsal side of the spinal cord; the membranes of the spinal cord pass over the dorsal fissure and do not enter it. ↑ VENTRAL HORN · MENINGES

HB099 central canal (*n.*) A narrow-bore canal running the length of the spinal cord and situated centrally; it is filled with cerebrospinal fluid. At the anterior end it connects with the fourth ventricle of the brain. ↑ VENTRICLE[2] · VENTRAL HORN · CEREBROSPINAL FLUID

HB100 neural canal (*n.*) A canal formed by the neural arches of the vertebrae; it encloses and protects the spinal cord. ↓ SPINAL CANAL · VERTEBRAL CANAL · NEUROMERE · FASCICULUS ↑ SPINAL CORD → VERTEBRA

HB101 spinal canal (*n.*) Alternative term for NEURAL CANAL.

HB102 vertebral canal (*n.*) Alternative term for NEURAL CANAL.

HB103 neuromere (*n.*) A segment of the spinal cord corresponding to a metamere; it corresponds in length to the extent of

attachment of a pair of spinal nerves. A neuromere forms a spinal level to which nerve tracts are connected. It is a division of convenience, not a structural unit. ↑ NEURAL CANAL → METAMERE

HB104 fasciculus (*n.,pl.* **fasciculi**) A bundle or tract of nerve fibres, *e.g.* a tract of nerves in the spinal cord. ↑ NEURAL CANAL

HB105 multiple sclerosis (*n.*) Hardening of the tissues of the spinal cord or of the brain; the nervous tissue at different points is destroyed, and changes to hard masses of neuroglia; it causes paralysis and eventual death. ↑ SPINAL CORD → NEUROGLIA

HB106 hind-brain (*n.*) (In vertebrates) the cerebellum and the medulla oblongata; it tapers off gradually to the spinal cord at the posterior end and is connected to the mid-brain at the anterior end. ↓ MEDULLA OBLONGATA · CEREBELLUM · PONS VAROLII ↑ BRAIN · SPINAL CORD

HB107 medulla oblongata (*n.*) The posterior part of the hind-brain continuous with the spinal cord. In all vertebrates, it is a cone-shaped body, with the base at the anterior end, and the posterior end tapering into the spinal cord. It has grey matter on the inside and white matter on the outside; it has an internal cavity, filled with cerebrospinal fluid, the fourth ventricle. It has thick walls and floor but a thin roof. Its functions include coordination of impulses from touch receptors, hearing and taste organs, and the lateral line (of fishes). It controls automatic processes, such as heart beat, contraction and dilation of blood vessels, and various reflex actions, such as swallowing. Often simply called the ***medulla***. ↓ CEREBELLUM · PONS VAROLII ↑ GREY MATTER · CEREBROSPINAL FLUID · HIND-BRAIN

HB108 cerebellum (*n.*) A dorsal outgrowth from the anterior end of the hind brain. In reptiles and amphibia, it is a small structure; in mammals, it is a large structure, and in birds and fishes a very large structure in comparison with other parts of the brain. In reptiles and amphibians it consists of a band of nervous tissue across the dorsal side of the medulla; in other vertebrates it consists of lobes which project over the mid-brain. In mammals, there is a cortex of grey matter, with white matter innermost; the lobes of the cerebellum are connected by tracts of nerve fibres, the pons Varolii In man, the cerebellum is highly developed. The function of the cerebellum is to maintain a correct sense of balance, and, by coordinating complex muscular movement, to maintain balance. —***cerebellar*** (*adj.*) ↑ MEDULLA OBLONGATA

HB109 pons Varolii (*n.*) A thick tract of nerve fibres, mainly white matter with some grey matter intermixed. It forms a bridge for nervous impulses between the lobes of the cerebellum, and also connects the cerebellum to the medulla oblongata and to the cerebrum. It occurs in vertebrates with developed cerebellar lobes. Three cranial nerves originate in the pons; through them the pons controls salivation, lacrimation, facial expression and ocular movement. ↑ MEDULLA OBLONGATA

HB110 cerebellar (*adj.*) Of or to do with the cerebellum, *e.g.* cerebellar lobes. ↑ HIND-BRAIN

HB111 mid-brain (*n.*) A thick-walled, tubular structure with an internal cavity, the cerebral aqueduct, which is a narrow tubular cavity connecting the third and fourth ventricles. It is situated between the cerebellum and the diencephalon, the former being posterior to it and the latter anterior to it. The primitive vertebrate mid-brain is concerned mainly with controlling the sense of sight. The oculomotor and the trochlear cranial nerves originate from the mid-brain. ↓ OPTIC LOBE ↑ BRAIN · DIENCEPHALON · HIND-BRAIN

HB112 optic lobe (*n.*) (In vertebrates other than mammals) one of a pair of ovoid structures on either side of and dorsal to the brain stem of the mid-brain. The optic nerves come to the optic lobes through the optic chiasma. In mammals, there are four rounded outgrowths, the corpora quadrigemina, two dorsal and two ventral to the brain stem. The dorsal pair (cranial in man) function as visual reflex centres; the ventral pair (caudal in man) function as auditory reflex centres. ↓ CORPORA QUADRIGEMINA · CEREBRAL PEDUNCLE · CRURA CEREBRI · OPTIC CHIASMA ↑ MID-BRAIN

HB113 corpora quadrigemina (*n.pl.*) (In mammals) four outgrowths from the mid-brain. See OPTIC LOBE (↑).

HB114 cerebral peduncle A cylindrical column of white matter situated on the floor of the mid-brain. There are two cerebral peduncles, one on either side of the median line of the mid-brain; they consist of tracts of nerve fibres connecting the pons varolii to the cerebrum. ↑ TRACT[2] · OPTIC LOBE

HB115 crura cerebri (*n.pl.*) Alternative term for the CEREBRAL PEDUNCLES.

HB116 fore-brain (*n.*) In vertebrates, this consists of the telencephalon and the diencephalon; the part of the brain that shows the greatest development in the higher vertebrates. The primitive vertebrate fore-brain is concerned with the sense of smell and contains the olfactory lobes; it is also concerned with vision and the maintenance of equilibrium and contains the optic thalami. The higher forms of vertebrates have developed fore-brains concerned with conscious action. ↓ OPTIC THALAMI · PINEAL APPARATUS · PITUITARY GLAND · LAMINA TERMINALIS · OLFACTORY LOBE · CEREBRUM ↑ BRAIN · DIENCEPHALON

HB117 optic thalami (*n.pl.*) (In fishes, reptiles, amphibians, birds, and the lower mammals) an enormous thickening of the lateral walls of the third ventricle in the diencephalon. They form the floor of the thalamencephalon; from them run the optic nerves to the eyes In the lower vertebrates, they form the highest centres for the coordination of sensory impressions As

vertebrates evolved, the thalami became of less importance and acted as relay stations to the cerebrum. ↓ OPTIC CHIASMA · THALAMUS[1] · HYPOTHALAMUS ↑ FORE-BRAIN

HB118 optic chiasma (*n.*) A structure in the ventral surface of the diencephalon, formed from nerve fibres of the optic nerves crossing from left to right and right to left of the brain. In mammals, half of the nerve fibres from each optic nerve cross over, the remaining half are connected to the optic lobes on the same side of the brain as the eye. In all other vertebrates, all the nerve fibres cross over. ↑ OPTIC THALAMI

HB119 thalamus[1] (*n.*) A collective term for the two ovoid, ganglionic outgrowths on either side of the diencephalon of man and the higher mammals. The two thalami extend posteriorly and overlap the midbrain. It is an area of synaptic junctions for ascending tracts of nerve fibres to the cerebrum. It interprets crude sensations of heat, cold, pain, etc., which are then relayed to the cerebrum for fuller interpretation. ↑ OPTIC THALAMI

HB120 hypothalamus (*n.*) Situated in the region below the thalamus, it is a structure forming the greater part of the floor and sides of the third ventricle. It is formed mainly from the diencephalon, but the anterior part by the telencephalon. It consists of brain nuclei coordinating body temperature control, the emotion of anger and partial control of the pituitary gland; its nuclei are the chief integrating centres for the autonomic nervous system. Only found in the higher mammals, its functions are undertaken by the optic thalami in lower vertebrates. ↑ OPTIC THALAMI

HB121 pineal apparatus (*n.*) The two outgrowths on the median line of the roof of the diencephalon, one behind the other; the anterior outgrowth is the parietal organ, which forms an eye-like structure in lampreys and some reptiles, called a pineal eye, and is absent, or much reduced, in other vertebrates; the posterior outgrowth forms a glandular pineal body, called an **epiphysis**, in most vertebrates. ↓ PINEAL EYE · PINEAL BODY · PINEAL GLAND · EPIPHYSIS · EPITHALAMUS ↑ FORE-BRAIN

HB122 pineal eye (*n.*) A sac-like outgrowth on the roof of the ventricle formed by a diverticulum of the third ventricle. The structure varies in different types of vertebrates, being found in lampreys and reptiles. In its most complete form it contains a lens and a retina, with a gap in the skull above the eye and an almost transparent membrane crossing the gap. The nerve from the retina is present in lampreys but degenerates in adult reptiles. ↑ PINEAL APPARATUS

HB123 pineal body (*n.*) A structure consisting of a pineal stalk, terminating in a round pineal body. Its function is unknown, but it is assumed to secrete a hormone. ↑ PINEAL APPARATUS

HB124 pineal gland (*n.*) Alternative term for PINEAL BODY.

HB125 epiphysis (*n.*) Alternative term for PINEAL BODY.

HB126 epithalamus (*n.*) The epithalamus comprises the pineal apparatus, the posterior commissure, and a covering membrane. The whole forms the roof of the thalamencephalon. ↑ PINEAL APPARATUS

HB127 pituitary gland (*n.*) A structure on a stalk; it is situated on the floor of the diencephalon immediately below the hypothalamus. It is an endocrine gland secreting a mixture of hormones (at least 9 have been identified). It has two main parts, the posterior and anterior lobes. The posterior lobe (or neural lobe and stalk, or neurohypophysis), secretes ADH, vasopressin, and other hormones. The anterior lobe (or glandular lobe, or adrenohypophysis), secretes ACTH, growth and other hormones. ↓ INFUNDIBULUM · PITUITARY BODY · HYPOPHYSIS ↑ FORE-BRAIN

HB128 infundibulum (*n.*) The stalk of the hypophysis (or pituitary gland), which connects the hypophysis to the floor of the diencephalon. ↑ DIENCEPHALON · PITUITARY GLAND

HB129 pituitary body (*n.*) Alternative term for PITUITARY GLAND (↑).

HB130 hypophysis (*n.*) Alternative term for PITUITARY GLAND (↑).

HB131 lamina terminalis (*n.*) A thin plate of tissue, the anterior wall of the third ventricle, and a blind end of the brain stem. ↓ THALAMENCEPHALON · METATHALAMUS ↑ FORE-BRAIN · BRAIN STEM

HB132 thalamencephalon (*n.*) The thalamencephalon comprises the thalamus, metathalamus, and the epithalamus. It is part of the diencephalon. ↑ LAMINA TERMINALIS · DIENCEPHALON

HB133 metathalamus (*n.*) The metathalamus consists of tracts of nerve fibres connecting the thalamencephalon with the cerebrum and the optic chiasma. The structure is assumed to be associated with the perception of colour vision. ↑ LAMINA TERMINALIS

HB134 cerebrum (*n.*) (In fishes) a round swelling on the anterior part of the forebrain. In other vertebrates, the cerebrum is an outgrowth of the fore-brain with a fissure which separates the cerebrum into two halves; in birds and mammals, these halves have a hemispherical shape. The two parts of the cerebrum are called cerebral hemispheres. In the cerebrum are two lateral ventricles, each connected to the third ventricle in the diencephalon. In the lower vertebrates, the cerebrum is concerned with the sense of smell. In amniotes, it develops coordination functions, which become predominant. In mammals, further development results in control of most of the animal's activities. ↓ OLFACTORY LOBE · CEREBRAL HEMISPHERES · CORPUS CALLOSUM · CEREBRAL LOBE ↑ BRAIN · FORE-BRAIN

HB135 olfactory lobe (*n.*) One of two terminal outgrowths from the fore-brain of primitive vertebrates, or from the cerebral

hemispheres of other vertebrates. It is concerned with the sense of smell, and from it the olfactory nerve runs to the organs of smell. The olfactory lobes are well developed in those vertebrates relying mainly on the sense of smell. ↓ OLFACTORY BULB ↑ CEREBRUM

HB136 olfactory bulb (*n.*) (In some vertebrates) a rounded mass formed at the end of an olfactory lobe; the olfactory nerve in man originates in the olfactory bulb. ↑ OLFACTORY LOBE

HB137 cerebral hemispheres (*n.pl.*) A pair of ovoid outgrowths from the anterior end of the fore-brain separated by a median fissure. In amphibians and reptiles, the hemispheres form a roof over the fore-brain; in birds and mammals, they develop further by complex folding, until in mammals the cerebral hemispheres envelop the whole brain. In man, the outer surface of the cerebral hemispheres is much folded into convolutions with deep fissures between the different parts. The function of the cerebral hemispheres is the interpretation of all stimuli received by receptors, the development of memory, and the causation of voluntary actions. In man, they control all mental activities and exhibit the mental process of intelligence. Each hemisphere consists of the pallium and the basal ganglia, and contains a lateral ventricle. The two lateral ventricles are connected to the third ventricle. ↓ PALLIUM · NEOPALLIUM · CEREBRAL CORTEX · CEREBRAL MEDULLA · BASAL GANGLIA · BASAL NUCLEI ↑ CEREBRUM

HB138 pallium (*n.*) In lower vertebrates, the grey matter tends to be on the inside of the cerebrum, and white matter on the outside, but in mammals the cerebral roof, or pallium, has an outer cerebral cortex of grey matter, and internal white matter, the cerebral medulla. —***neopallium*** (*n.*) ↑ CEREBRAL HEMISPHERES

HB139 neopallium (*n.*) The part of the pallium not associated with the sense of smell. In mammals, this is the greater part of the pallium. ↑ CEREBRUM · CEREBRAL HEMISPHERES

HB140 cerebral cortex (*n.*) (In amniotes) the outer layer of the cerebral hemisphere, consisting of grey matter, rich in synapses; it is extensive only in mammals, by means of fissures and folds. The greater the number of fissures, the greater the degree of intelligence exhibited by the animal. ↑ CEREBRAL HEMISPHERES → SYNAPSE

HB141 cerebral medulla (*n.*) The inner part of a cerebral hemisphere, consisting of white matter. ↑ CEREBRAL HEMISPHERES

HB142 basal ganglia (*n.pl.*) The deep lying masses of grey matter in the cerebral hemispheres; they consist of ganglia which connect the hemispheres with other nerve centres of the brain. Their function is uncertain. ↑ CEREBRAL HEMISPHERES → GANGLION

HB143 basal nuclei (*n.pl.*) Alternative term for BASAL GANGLIA. ↑ CEREBRAL HEMISPHERES

HB144 corpus callosum (*n.*) A thin, flat, commissure of nerve fibres which provides a connection for nerve impulses between the two cerebral hemispheres. It is situated at the bottom of the deep longitudinal fissure separating the two cerebral hemispheres. ↓ FORNIX · CORPUS STRIATUM · ASSOCIATION TRACTS ↑ CEREBRUM

HB145 fornix (*n.*) A commissure below and joined to the corpus callosum. ↑ CORPUS CALLOSUM

HB146 corpus striatum (*n.pl.* **corpora striata**) A thick bundle of white matter with some grey matter, with a striped appearance. It consists of ganglia which form the base of the wall of a cerebral hemisphere, and it also forms the floor of a lateral ventricle in the cerebrum. There are two corpora striata; they function as motor centres of the brain, modifying olfactory impressions by impressions received from other senses. In higher vertebrates, this function is modified to a subsidiary role. ↑ CORPUS CALLOSUM

HB147 association tracts (*n.pl.*) Tracts of nerve fibres running to each part of the cerebral hemispheres; they form the cerebral medulla. Their function is to provide pathways for impulses to associate different stimuli which are then interpreted by the cerebral cortex. ↑ CORPUS CALLOSUM

HB148 cerebral lobe (*n.*) Each cerebral hemisphere is divided, more or less arbitrarily, into different regions, each region being a lobe. The deeper fissures are used to distinguish the lobes. Each lobe is named from the part of the skull near which it is situated. A term of convenience, not one of anatomical or physiological significance. ↓ SULCI · CEREBRAL FISSURES · FORAMEN OF MUNRO ↑ CEREBRUM · CEREBRAL HEMISPHERES

HB149 sulci (*n.pl., sing.* **sulcus**) The superficial fissures which increase the surface area of the cerebral cortex. The pia mater dips down into the fissures. ↑ CEREBRAL LOBE

HB150 cerebral fissures (*n.pl.*) Alternative term for SULCI. ↑ CEREBRAL LOBE

HB151 foramen of Munro (*n.*) The small aperture connecting a lateral ventricle with the third ventricle. ↑ CEREBRAL LOBE

HB152 neural arc (*n.*) The connection by afferent and efferent nerve fibres between a receptor and an effector. The simplest example is a simple reflex arc; more complex arcs include control by higher nerve centres of the nervous system, *e.g.* the brain. ↓ REFLEX ACTION · BEHAVIOUR[3] ↑ NERVOUS SYSTEM → IRRITABILITY

HB153 reflex action (*n.*) In almost all animals with a nervous system, a reflex action is a form of behaviour in which a certain stimulus causes one specific response. The form of behaviour and the stimulus are very simple in nature, *e.g.* putting a finger on a hot object causes the immediate withdrawal of the finger. The delay between sensing the stimulus and making the response is barely noticeable. The response is constant and immediate because there is an inborn

nervous pathway, called a reflex arc, which conducts the nerve impulses. It is an involuntary action. ↓ REFLEX ARC · EXTEROCEPTOR · INSTINCT · TACTILE · NEUROHUMORAL ↑ NEURAL ARC

HB154 reflex arc (*n.*) The simplest reflex arc involves at least three neurons. A receptor initiates impulses in a sensory nerve fibre; the sensory neuron conducts the impulse. An association neuron conducts the impulse from a synapse with the sensory neuron to a synapse with a motor neuron. The motor neuron conducts the impulse to an effector. The effector is activated. ↓ SIMPLE REFLEX · CONDITIONED REFLEX · UNCONDITIONED REFLEX · ASSOCIATION[2] · HABITUATION ↑ REFLEX ACTION

HB155 simple reflex (*n.*) A specific, single response of an animal to a particular stimulus; it occurs in all animals with a nervous system; there is a barely perceptible delay between stimulus and response. It is the simplest form of behaviour and is independent of experience, *e.g.* ***a*** touching a hot object (a stimulus) with a hand (a receptor); the hand is immediately withdrawn (a reflex); this is a simple reflex. —REFLEX (*adj.*) ↑ REFLEX ARC

HB156 conditioned reflex (*n.*) A reflex which is formed from experience. In a conditioned reflex, the original sensory component of stimulus, receptor, and sensory neuron, is replaced by a secondary sensory component, but the motor component of the reflex arc remains unchanged, *e.g.* the smell of food (an original stimulus) causes salivation (an original reflex) in a dog; by associating the ringing of a bell at the same time as the presenting of food, the ringing of a bell (a secondary stimulus) causes salivation (the same motor component). A conditioned reflex becomes weaker with time and must be reinforced by repeating the original experience The salivation in response to the smell of food (an unconditioned reflex) is not affected, or altered, by the experience. In man, conditioned reflexes control many actions, *e.g.* walking, playing ball games, writing, are all conditioned reflexes which have been learned from experience. ↑ REFLEX ARC

HB157 unconditioned reflex (*n.*) A reflex which is inborn; it does not become weaker with time. ↑ REFLEX ARC

HB158 association[2] (*n*) When two or more events or stimuli are related in time or in sequence, and the events or stimuli are perceived by the senses, they can be associated by the central nervous system of an animal Repetition of the events or stimuli strengthens the association. The perception of one event or one stimulus can replace the perception of the others, *e.g.* a dog is shown a red ball when given food; the two events become associated and repetition strengthens the association; finally, on perceiving the ball, the dog responds as if perceiving food, *i.e.* by salivation Association is the basis of conditioned reflexes —***associated*** (*adj.*) ASSOCIATE (*v.*) ↓ LEARN ↑ REFLEX ARC

HB159 habituation (*n.*) The adjustment in the response of a cell or of an organism, effected by continual contact with identical stimuli, in which the stimulus produces a diminishing effect, *e.g.* the odour of ether is distinctive, but when ether is smelled for some time, the sensation caused by the odour diminishes until it finally vanishes. ↓ HABIT ↑ REFLEX ARC

HB160 exteroceptor (*n.*) A receptor which perceives stimuli outside an animal, such as light, sound, smell, taste, or touch, *i.e.* a receptor associated with the senses. —***exteroceptive*** (*adj.*) ↓ INTEROCEPTOR · PROPRIOCEPTOR · EFFECTOR[1] · END-ORGAN ↑ REFLEX ACTION → RECEPTOR · STIMULUS

HB161 interoceptor (*n.*) **1** A receptor which perceives stimuli from inside an animal. **2** (A restricted meaning) an end-organ for perceiving stimuli arising in the viscera. ↑ EXTEROCEPTOR

HB162 proprioceptor (*n.*) **1** One of the number of receptors located in the muscles, tendons and joints; they are stimulated by passive stretch or contraction of a muscle. **2** One of the balancing organs in the inner ear which are stimulated by movement. Proprioceptors detect position and movement of the body; they provide a kinaesthetic sense for an organism.↑EXTEROCEPTOR

HB163 effector[1] (*n.*) An organ or cell that is activated in response to a stimulus and by which an animal acts. The main effectors are muscles (striped, smooth, and cardiac) and glands (visceral and other organs in an animal); other effectors are cilia, thread-cells, and chromatophores. ↑ EXTEROCEPTOR

HB164 end-organ (*n.*) A small structure at the distal end of a nerve fibre which is connected to the peripheral nervous system. It may contain one or more cells; it acts as a receptor, or it may transform a nervous impulse into the stimulus for an effector. ↑ EXTEROCEPTOR → END-BULB

HB165 instinct (*n.*) (In animals) a complex pattern of successive reflexes forming a whole activity in response to particular stimuli; the pattern is inborn, and not dependent on earlier experience, *e.g.* ***a*** the building of a nest by a bird; ***b*** the swimming of mammals; ***c*** the spinning of cocoons by insects; ***d*** the courtship display of birds. Instincts are important as they provide for survival and successful rearing of young after reproduction. In man, instinctive reflexes are few, and mainly physical. —***instinctive*** (*adj.*) ↓ RELEASER · SOCIAL RELEASER · BEHAVIOUR[3] ↑ REFLEX ACTION

HB166 releaser (*n.*) A stimulus which initiates an instinctive activity, *e.g.* a loud noise is a releaser for the instinctive act of evasion, the type of act depending on the animal concerned, *i.e.* running away or crouching down to hide. The releaser may be dependent on the presence of a hormone The hormone does not cause instinctive activity but it makes possible the effect

of a releaser. The periodic occurrence of certain instinctive behaviour patterns, such as the display by male birds at defined breeding seasons, is under hormonal control. ↑ INSTINCT

HB167 social releaser (*n.*) A releaser emanating from an animal of the same species as the animal responding, *e.g.* the dance of a honey bee. ↑ INSTINCT

HB168 tactile (*adj.*) Describes any nerve receptor associated with the sense of touch. ↓ KINAESTHETIC ↑ REFLEX ACTION

HB169 kinaesthetic (*adj.*) Describes the sense of movement, balancing, or muscular effort. By its kinaesthetic sense, an animal determines its relative position in space, and the relative positions of different parts of its body; its body can be stationary, moving, or in motion. ↑ TACTILE

HB170 neurohumoral (*adj.*) Describes the action of transmitting the effects of impulses from a nerve across a synapse or to an end-organ. Transmission is effected by the diffusion of acetylcholine or adrenalin from the afferent nerve endings to the efferent nerve. The substances are neurohumoral. ↓ CHOLINERGIC · ADRENERGIC ↑ REFLEX ACTION → SYNAPSE

HB171 cholinergic (*adj.*) Describes a nerve fibre which secretes acetylcholine at its terminal branches when nerve impulses arrive. In vertebrates, the following are cholinergic nerve fibres: sensory, motor to striped muscle, preganglionic from central nervous system to sympathetic ganglia, parasympathetic to smooth muscle. ↑ NEUROHUMORAL

HB172 adrenergic (*adj.*) Describes a nerve fibre which secretes adrenalin at its terminal branches when nerve impulses arrive. In vertebrates, the following are adrenergic nerve fibres: postganglionic sympathetic, except those to sweat glands, which are cholinergic. ↑ NEUROHUMORAL

HB173 behaviour[3] (*n.*) The physical actions of animals in response to the general environment, a particular object, or a particular event. Behaviour can arise from instinct (instinctive behaviour) or from experience (habit and inhibition), *e.g.* ***a*** the physical actions of a male bird when it displays a courtship dance to a female bird is instinctive behaviour; ***b*** the physical actions of an animal in a conditioned reflex is its behaviour. ↓ EXPERIENCE · WILL · COMA · LEARN · MENTAL · INNATE ↑ REFLEX ACTION · NEURAL ARC ·

HB174 experience (*n.*) The repeated perception of identical events or identical stimuli. Experience of such events or such stimuli leads to association. —***experience*** (*v.*) ↓ INTERPRETATION · MEMORY · HABIT · AWARENESS · EMOTION ↑ ASSOCIATION[2] · BEHAVIOUR[3]

HB175 interpretation (*n.*) The coordination of sensation with previous experience, or with reasoning, so as to identify a stimulus or its source, or to determine the possible effect of the stimulus, and then to prepare for a voluntary action in response to the stimulus. In the cerebral hemispheres, one area is concerned with the perception of sensation, another area with the interpretation of sensation, *e.g.* a musical note is perceived in one area of the brain, and in another area past experience is used to identify the source of the note, and the instrument making the note, *i.e.* to interpret the sensation. ↑ EXPERIENCE → REASON

HB176 memory (*n.*) The store of past experience in the brain. It enables the formation of concepts and the process of learning to be performed, *e.g.* a horse is seen and a concept is formed; the storage of the concept is a form of memory. ↑ EXPERIENCE → CONCEPT

HB177 habit (*n.*) **1** The manner of growth, behaviour, or movement, usual in an organism, *e.g.* ***a*** the habit of some plants to climb by twining round a support in a clockwise fashion; ***b*** the habit of fish to hide beneath rocks in a pool. **2** (In animals) the regular performance of a particular act or pattern of activities resulting from experience, *i.e.* similar to a conditioned reflex, but not necessarily requiring a stimulus, *e.g.* cows leave a field and walk to a milking shed at a definite time; this is a habit dependent on time and occurring regularly every day. —HABITUATION (*n.*) ***habitual*** (*adj.*) ↑ EXPERIENCE → HABITUATION

HB178 awareness (*n.*) A state of knowledge an animal possesses of itself or of its surroundings, *e.g.* ***a*** the awareness of a horse when it is wet with rain; ***b*** the awareness of a cat when it smells a mouse, *i.e.* the cat becomes aware of the presence of the mouse; ***c*** the awareness of a student when he observes a drop of ink dissolving in a beaker of water, *i.e.* the student perceives the state of affairs, becoming aware of the process that has taken place. —AWARE (*adj.*) ↑ EXPERIENCE

HB179 emotion (*n.*) A strong reaction by the brain in response to external stimuli; it does not include reflex action inborn or formed by habit. Emotions include fear and anger; fear is experienced in the brain when danger is perceived, and the possible outcome of the danger is also perceived by reasoning. For an animal to exhibit fear it must possess intelligence □ *an animal exhibits emotions by displaying the signs of the emotion; emotions are difficult to control* —EMOTIONAL, EMOTIVE (*adj.*) ↑ EXPERIENCE

HB180 will (*n.*) The brain of animals with a central nervous system controls the coordination of the animal's movements. In invertebrates, behaviour is mainly instinctive, and coordination mainly ensures the stopping of unnecessary reflexes, although conditioned reflexes can be formed; the process of learning is slow, and not completely efficient. In vertebrates, conditioned reflexes are made more easily and modify instinctive reflexes. A vertebrate brain has an activity of its own in addition to the coordination of immediate reflex action;

this is seen in the influence of past experience on immediate performance. A vertebrate has a selection of responses available to a particular stimulus, or event; in selecting a response the animal is exercising its will. The animal can also initiate action without a stimulus, and independently of a habit, by exercising its will. □ *an animal exercises its will when it decides on a course of action* ↓ VOLUNTARY ACTION · INVOLUNTARY ACTION · INTELLIGENCE · CONSCIOUSNESS · UNCONSCIOUSNESS · REASON ↑ BEHAVIOUR[3]

HB181 voluntary action (*n.*) An action performed because of the exercise of the will of an animal through the involvement of the C.N.S. A voluntary action takes place at an appreciable length of time after the perception of a stimulus. Compare a **reflex action** which takes place after a barely perceptible delay. ↑ WILL

HB182 involuntary action (*n.*) An action performed by a muscle or a gland because of a reflex, not controlled by the will and not involving the C.N.S. The autonomic nervous system is responsible for most involuntary actions, the remaining involuntary actions arise from simple or conditioned reflexes. ↑ WILL

HB183 intelligence (*n.*) Considered to be the degree of ability in reasoning, *i.e.* the degree of ability to respond, act or adjust, mentally or physically, to new experiences. —***intelligent*** (*adj.*) ↑ WILL

HB184 consciousness (*n.*) The state of an animal when it is conscious. ↓ COMA (I) · CONSCIOUS ↑ WILL

HB185 unconsciousness (*n.*) The state of being unconscious, produced under abnormal circumstances. ↑ WILL

HB186 coma (*n.*) A condition in which an animal is completely unconscious and does not respond to any physical stimuli. It is caused by severe illness or damage to the brain. ↓ CONCUSSION ↑ BEHAVIOUR[3] · CONSCIOUSNESS (I)

HB187 concussion (*n.*) In higher vertebrates, concussion is caused by a violent blow on the head; it results in malfunctioning of the brain. The condition can vary from mild concussion, in which mental activities and response to stimuli are only slightly affected, to severe concussion, in which the animal is in a coma. —***concussed*** (*adj.*) ↑ COMA

HB188 learn (*v.t.,i.*) To form associations from experience, *e.g.* a child experiences different stimuli when attempting to walk; these stimuli become associated in the central nervous system, and each stimulus produces successive reflexes. The complex pattern of reflexes becomes established as a conditioned reflex of walking; it has been learned. As the pattern has been learned, it can be forgotten; constant repetition prevents loss of the pattern by strengthening the associations. —***learning*** (*n.*) ↓ FORGET · REASON ↑ EXPERIENCE · BEHAVIOUR[3] · ASSOCIATION[2]

HB189 forget (*v.t.,i.*) **(forgot, forgotten)** To lose the response to a conditioned reflex, or to lose a habit. Forgetting is necessary for animals living by reflex actions. When a habit is no longer of use, time is wasted in performing the action, so the habit is forgotten, *e.g.* a rat has a habitual run from its nest to food; if the food source no longer exists, the particular habitual run is forgotten. —***forgetting*** (*n.*) ***forgotten*** (*adj.*) ↓ REMEMBER (Cn) ↑ CONDITIONED REFLEX · LEARN

HB190 reason (*v.i.*) To be able to know beforehand the result of a particular action. Reasoning does not depend on previous experience (experience produces a conditioned reflex). The ability to reason is limited to monkeys, apes and man, although only in man is it highly developed, *e.g.* if fruit on a tree is out of reach, a man gets a ladder to reach the fruit (he knows beforehand that climbing the ladder will put the fruit in reach). —***reasoning*** (*n.*) ↑ LEARN

HB191 remember (*v.t.,i.*) To keep the response to a conditioned reflex, or to keep a habit. —***remembrance*** (*n.*) ↑ LEARN · FORGET (Cn)

HB192 mental (*adj.*) Of or to do with the processes which take place in the brain and involve the association of neurons, *e.g.* mental activity is the association and interpretation of memories and sensations. ↓ CONSCIOUS · UNCONSCIOUS · ASLEEP · AWARE · UNAWARE · EMOTIONAL · EMOTIVE ↑ BRAIN · BEHAVIOUR[3] → PHYSICAL (I)

HB193 conscious (*adj.*) Describes an animal whose brain is functioning for the reception of physical stimuli, for the interpretation of stimuli for voluntary action in response to the stimuli, and for learning and forgetting □ *the animal is conscious of its actions* —***consciousness*** (*n.*) ↓ UNCONSCIOUS (I) · ASLEEP (I) ↑ MENTAL

HB194 unconscious (*adj.*) Describes the condition of an animal whose brain is not functioning for the reception of stimuli, other than tactile stimuli which cause a simple reflex. It is not a natural condition and is caused by temporary damage to the brain, or by illness. Contrast **asleep** which describes a natural condition of rest, in which the brain is not conscious, but responds to a wider range of physical stimuli. —***unconsciousness*** (*n.*) ↓ ASLEEP (Sn) ↑ CONSCIOUS (I) · MENTAL

HB195 asleep (*adj.*) Describes an animal in a normal periodic condition of not being conscious. The brain is not functioning for voluntary actions, but is functioning for all involuntary actions □ *the man is asleep* —***sleep*** (*n.*) ***sleep*** (*v.*) ↑ MENTAL

HB196 aware (*adj.*) Describes an animal in a state of awareness □ *the animal is aware of its surroundings* ↓ UNAWARE (Cn) ↑ MENTAL · AWARENESS

HB197 unaware (*adj.*) Describes an animal which is not in a state of awareness of particular events or objects in its surroundings, *e.g.* a buffalo feeding on grass is unaware of the approach of a tiger. ↑ MENTAL

HB198 emotional (*adj.*) To do with emotion, *e.g.* a man seeing a wild animal about to attack him has the emotional experience of fear. ↑ MENTAL

HB199 emotive (*adj.*) Describes an agent causing emotion, *e.g.* a wild animal about to attack a man is emotive to the man. ↑ MENTAL

HB200 innate (*adj.*) Describes a characteristic, pattern of behaviour, or reaction of an organism, with which it is born and it does not have to learn or acquire, *e.g.* ***a*** the ability to build a nest is innate in most birds; ***b*** an instinct is an innate characteristic, *e.g.* the instinct of some animals to store food for the winter. ↑ BEHAVIOUR

Sight

HC001 sight (*n.*) The sense for which light is the stimulus, and by which impressions of physical objects in the environment (images) are conveyed to the central nervous system by an optic nerve. Sight is a sense found in arthropods and vertebrates. Invertebrates possessing photoreceptors, such as earthworms, are sensitive to light, but do not possess sight. ↓ VISION · BINOCULAR VISION · EYE · OCELLUS · VISUAL · OCULAR · COMPOUND EYE · EYEBALL · EYELID · CRYSTALLINE LENS · RETINA → IRRITABILITY · PHOTOTAXIS · PHOTOKINESIS

HC002 vision (*n.*) The process of perceiving the environment by sight. Different animals use different structures and mechanisms, and correspondingly have different forms of vision; those not possessing sight have no vision. ↓ ACUITY OF VISION · VISUAL FIELD · VISUAL ANGLE · VISUAL AXIS · VISUAL PLANE ↑ SIGHT

HC003 acuity of vision (*n.*) The degree of the ability of vision to distinguish fine detail on an object; greatest in man and certain cephalopods. —ACUTE (*adj.*) ↑ VISION

HC004 visual field (*n.*) The extent of space observed by an eye without movement of the eye. ↑ VISION → FOVEA

HC005 visual angle (*n.*) The angle subtended at the eye by the limits of the visual field. ↑ VISION

HC006 visual axis (*n.,pl.* **visual axes**) (In vertebrates) the straight line between the point on which the eye is focussed, and the fovea (or macula) of the eye. ↑ VISION

HC007 visual plane (*n.*) The plane containing the visual axes of a pair of vertebrate eyes. ↑ VISION

HC008 binocular vision (*n.*) In primates, and carnivorous vertebrates generally, the pair of eyes are set in the front of the head in order that the eyeballs can be so directed that the image of an object is focussed on both retinas, particularly on the fovea or macula. The extent of convergence of the visual axes is probably the means by which distance is judged. Binocular vision allows distances to be judged and shapes to be perceived in depth (stereoscopic vision). ↓ STEREOSCOPIC VISION ↑ SIGHT · VISION

HC009 stereoscopic vision (*n.*) The ability to see objects as solid shapes in three dimensions because the two eyes of an animal see slightly different images as the visual axes are inclined at an angle to each other. ↑ BINOCULAR VISION

HC010 monocular vision (*n.*) In herbivores, generally, each eye is set at the side of the head, so that an object is seen with one eye only. The field of vision is much greater for animals with monocular vision than the field of vision for animals with binocular vision. The herbivore needs a large field of vision to detect predators, but the carnivore needs to judge distances accurately for attacking prey. ↑ BINOCULAR VISION

HC011 eye (*n.*) A receptor organ for light, by which an animal perceives its physical environment, and distinguishes to a varying degree one object from another. Most animals possess some form of eye, varying from very simple organs to the complex structures found in vertebrates □ *an eye views a near object; seen by the naked eye, i.e. seen without any aid such as spectacles, lens, etc.* ↓ EYE-SPOT · PHOTORECEPTOR · OCULAR SPOT ↑ SIGHT → RECEPTOR

HC012 eye-spot (*n.*) **1** A light-sensitive organelle containing a red pigment; it occurs in many motile algae. **2** A light-sensitive area found in some invertebrates, such as planarians and starfish; it consists of a cup-shaped concavity containing photoreceptor cells. ↑ EYE

HC013 photoreceptor (*n.*) A receptor sensitive to light. It defines a cell, or an organ of sight. The simplest photoreceptors occur in invertebrates, *e.g.* certain cells in the epidermis of the earthworm are sensitive to light. Such a cell possesses a mass of transparent material in the cytoplasm on the external surface, and nerve fibrils on the opposite side of the cell. The transparent mass acts as a simple lens; the fibrils are stimulated by the light directed on them. ↑ EYE

HC014 ocular spot (*n.*) Alternative term for EYE-SPOT. ↑ EYE

HC015 ocellus (*n.,pl.* **ocelli**) **1** (In invertebrates) a simple, single eye, or an eyespot. **2** (In arthropods) a dorsal simple eye, which consists of a transparent portion of the cuticle, below which are light-sensitive cells connected to an ocellar nerve. **3** A coloured, eye-like marking occurring on insects and on feathers. —***ocellation*** (*n.*) ***ocellar,***

ocellate, ocellated (*adj.*) ↓ STEMMA ↑ SIGHT

HC016 stemma (*n.,pl.* **stemmata**) (In arthropods) a simple eye; a lateral ocellus. ↑ OCELLUS

HC017 visual (*adj.*) Of or to do with vision, *e.g.* a visual memory is one in which objects that have been seen are remembered. ↓ VISIBLE · ACUTE[1] · SHARP[1] · INDISTINCT ↑ SIGHT

HC018 visible (*adj.*) Describes any object that can be seen by the naked eye or with a named optical instrument, *e.g.* Protozoa are visible under a microscope □ ***visible under a hand lens; visible to the naked eye —visibility*** (*n.*) ↑ VISUAL

HC019 acute[1] (*adj.*) (Of vision) describes the ability to see detail of near objects or to distinguish far objects clearly. —***acuity*** (*n.*) ↓ INDISTINCT (Ag) ↑ VISUAL

HC020 sharp[1] (*adj.*) (Of focus) describes an image with every detail visible. —***sharpness*** (*n.*) ↑ VISUAL → BLURRED (I)

HC021 indistinct (*adj.*) (Of vision) describes the inability to see detail on near objects or to distinguish far objects clearly. —***indistinctness*** (*n.*) ↑ VISUAL · ACUTE[1] (Ag)

HC022 ocular (*adj.*) Of or to do with the eye; eye-like; perceived by the eye. ↓ OCULATE · OCULOMOTOR · OPTIC · OPHTHALMIC ↑ SIGHT · EYE

HC023 oculate (*adj.*) Having eyes or eye-like spots. ↑ OCULAR

HC024 oculomotor (*adj.*) Causing movement of an eye. ↑ OCULAR

HC025 optic (*adj.*) To do with vision. ↑ OCULAR

HC026 ophthalmic (*adj.*) Of or to do with the eye, or with structures associated with the eye. ↑ OCULAR

HC027 compound eye (*n.*) A form of eye occurring in crustaceans and insects. The eye is composed of tubular elements (ommatidia) each containing a lens and light-sensitive cells. Each compound eye may comprise thousands of such elements which appear as square, or more usually as hexagonal, facets on the eye. Each element forms an image of a small portion of the visual field; the image of the whole visual field is formed by a combination of all the small images. A compound eye forms mosaic (apposition) or superposition images. ↓ OMMATIDIUM · OPHTHALMOPOD · MOSAIC IMAGE ↑ SIGHT

HC028 ommatidium (*n.,pl.* **ommatidia**) A single element of a compound eye. It is tubular in shape with a corneal lens at the distal end. Pigmented cells separate the ommatidia. A central refractive rod, the rhabdom, conducts light down the axis of the ommatidium. In crustaceans, the pigmented cells are also photoreceptors; in insects, photoreceptor cells are situated between the rhabdom and the pigmented cells. The pigmented cells prevent light passing from one ommatidium to those next to it. The ommatidia are disposed in a radial manner and supported on a basal membrane. ↓ RETINULA · RHABDOM ↑ COMPOUND EYE

HC029 retinula (*n.*) The group of photoreceptor cells at the proximal end of an ommatidium. ↓ RETINA ↑ OMMATIDIUM

HC030 rhabdom (*n.*) A transparent, rod-like refractive structure, composed of rhabdomeres; it is situated on the long axis of an ommatidium. It conducts light from the corneal lens to the photoreceptors. ↑ OMMATIDIUM

HC031 ophthalmopod (*n.*) An eye-stalk such as that on decapod crustaceans, *e.g.* crabs. ↑ COMPOUND EYE

HC032 mosaic image (*n.*) Each ommatidium forms an image only from light entering parallel to its long axis; this results in a mosaic pattern of small images, which are combined in the central nervous system to give an image of the whole visual field. The visual field is well adapted to detect movement, but not to focus on detail. The majority of diurnal insects possess compound eyes forming mosaic images. ↓ MOSAIC VISION · SUPERPOSITION IMAGE · APPOSITION IMAGE · DARK ADAPTATION ↑ COMPOUND EYE

HC033 mosaic vision (*n.*) Vision with compound eyes forming mosaic images. ↑ MOSAIC IMAGE

HC034 superposition image (*n.*) Photoreceptor cells receive light from ommatidia other than their own. Each retinula has a larger portion of the visual field than with a mosaic image. The superposition images overlap, and the image gains in luminosity, but the vision is less well adapted than mosaic vision to detect movement. The majority of nocturnal insects possess compound eyes with superposition images. ↑ MOSAIC IMAGE

HC035 apposition image (*n.*) (In compound eyes) the image formed when photoreceptor cells receive light only from their own ommatidium. Each retinula receives only its own part of the visual field, and there is no overlapping of images. This results in mosaic vision, best adapted for the detection of movement, although the image loses in luminosity. The majority of diurnal insects possess compound eyes forming apposition images. ↑ MOSAIC IMAGE

HC036 dark adaptation (*n.*) The ommatidia of some arthropods possess cells in which the dark pigment can migrate. In daylight, the pigment fills the cells, and the compound eye functions as an apposition eye, giving mosaic vision. At night the pigment migrates to the distal end of the cell, so the pigment cells no longer keep the light in the ommatidium, but allow other ommatidia to receive some of the light; the eye now functions as a superposition eye; the change in each case is temporary. **2** See VISUAL PURPLE for dark adaptation of a vertebrate eye. ↑ MOSAIC IMAGE → VISUAL PURPLE

HC037 eyeball (*n.*) (In vertebrates and cephalopods) the spherical structure composed of supporting tissues in which the photoreceptors and refractive media for concentrating light on the nervous tissues

are situated. The eyeball is divided into two chambers, anterior and posterior, by the iris. ↓ SCLEROTIC · CHOROID · CONJUNCTIVA · OPHTHALMOLOGY · OPHTHALMIA ↑ SIGHT

HC038 sclerotic (*n.*) The tough, fibrous, or cartilaginous, opaque outer coat of the eyeball; its function is to protect the eyeball and assist in maintaining its shape. It is continuous with the cornea in the front of the eye. —SCLEROTIC (*adj.*) ↓ SCLEROTIC COAT · SCLERA · CORNEA ↑ EYEBALL

HC039 sclerotic coat (*n.*) Alternative term for the SCLEROTIC.

HC040 sclera (*n.*) Alternative term for the SCLEROTIC.

HC041 cornea (*n.*) **1** The transparent covering at the front of the eyeball; it is the modified continuation of the sclerotic. In land vertebrates, it refracts light and is the most important element in the refractive system of the eye. **2** The transparent structure at the outer end of an ommatidium; a modified portion of it functions as a lens to refract light. —***corneal*** (*adj.*) ↑ SCLEROTIC

HC042 choroid (*n.*) The membraneous, pigmented middle layer of the eyeball, between the sclerotic and the retina. It contains numerous blood vessels. Its function is to absorb light to prevent internal reflection in the eyeball and to provide nourishment for the retina. It is absent in some vertebrates. The choroid is continuous with the iris in the front of the eye. ↓ CHORIOID MEMBRANE · CHORIOID COAT · IRIS · PUPIL ↑ EYEBALL

HC043 chorioid membrane (*n.*) Alternative term for the CHOROID.

HC044 chorioid coat (*n.*) Alternative term for the CHOROID.

HC045 iris (*n.*) The thin, circular, coloured sheet of muscular tissue at the front of the eyeball, forming the coloured part of the eye. A central opening, the **pupil**, allows light to enter the eyeball. Radiating muscles dilate the pupil, and a ring of muscle (a sphincter) round the pupil constricts the pupil. The regulation of the size of the pupil is a reflex action from the stimulus of light on the optic nerve; the iris controls the amount of light that enters the eyeball, and assists in accommodation for near objects. The iris divides the eyeball into anterior and posterior chambers. ↓ ACCOMMODATION ↑ CHOROID

HC046 pupil (*n.*) The opening in the iris of a vertebrate eye. In some vertebrates, such as cats, it is narrow and slit-like; in most vertebrates it is round. ↑ CHOROID

HC047 conjunctiva (*n.*) A delicate mucous membrane covering the cornea, the front part of the sclerotic, and lining the eyelids of vertebrates. It protects the cornea. ↓ AQUEOUS HUMOUR · VITREOUS HUMOUR ↑ EYEBALL

HC048 aqueous humour (*n.*) A watery fluid, similar in composition to cerebrospinal fluid. It fills the anterior chamber of the eyeball, behind the cornea; the iris and crystalline lens lie in it. It is continually secreted by the ciliary body and absorbed. It helps maintain the shape of the eyeball and assists in the refraction of light. ↑ CONJUNCTIVA

HC049 vitreous humour (*n.*) A jelly-like, transparent substance which fills the posterior chamber of the eyeball. It occupies the cavity between the crystalline lens and the retina. It helps maintain the shape of the eyeball and assists in the refraction of light. ↑ CONJUNCTIVA

HC050 ophthalmology (*n.*) The branch of medical science concerned with the structures, functions, defects and diseases of the eye. ↑ EYEBALL

HC051 ophthalmia (*n.*) A condition in which any of the structures of the eye are inflamed. Deep seated inflammation can be caused by agents of disease brought by the blood. ↓ CONJUNCTIVITIS · TRACHOMA · XEROPHTHALMIA ↑ EYEBALL

HC052 conjunctivitis (*n.*) Inflammation of the conjunctiva. ↑ CONJUNCTIVA · OPHTHALMIA

HC053 trachoma (*n.*) A contagious disease caused by a virus; it affects the lining of the eyelids by the formation of small, hard, granules. It can cause blindness. —***trachomatous*** (*adj.*) ↑ OPHTHALMIA

HC054 xerophthalmia (*n.*) A condition in which the cornea becomes dry and scaly. Caused by a deficiency in the diet of vitamin A (retinol). It can cause blindness. ↑ OPHTHALMIA

HC055 exophthalmia (*n.*) Protrusion of the eyeballs, usually caused by disease. —***exophthalmic*** (*adj.*) ↑ OPHTHALMIA

HC056 eyelid (*n.*) A fold of skin, with a muscular layer, situated one above and one below the eye of some vertebrates. The eyelids close to protect the eye. ↓ EYELASH · EYE MUSCLES · TEAR · LACHRYMAL[2] ↑ SIGHT

HC057 eyelash (*n.*) (In mammals) one of many hairs on the edge of the eyelids to protect the conjunctiva, when the eyelids are open, against foreign bodies. ↓ NICTITATING MEMBRANE · ORBIT[1] ↑ EYELID

HC058 nictitating membrane (*n.*) A third eyelid consisting of a transparent membrane, which lies at the anterior or inner corner of the eye and is drawn across the eye. It assists in cleaning the eyeball. It occurs in some sharks, in amphibians, reptiles, and birds, and in a few mammals, such as cats. ↑ EYELASH

HC059 orbit[1] (*n.*) **1** A bony cavity in the skull of vertebrates; the eyeball is situated and swivels in the orbit. **2** The opaque membrane encircling the eye of a bird. ↑ EYELASH

HC060 eye muscles (*n.pl.*) Of the eye muscles, the **extrinsic muscles** are those outside the eyeball, *i.e.* the rectus and oblique muscles; the **intrinsic muscles** are those inside the eyeball, *i.e.* the iris and ciliary muscles. ↓ RECTUS MUSCLE · OBLIQUE MUSCLE ↑ EYELID

HC061 rectus muscle (*n.*) One of four muscles concerned with moving the eyeball, they are the superior and inferior (which move the eye up and down); the lateral and

medial (which move the eye left and right). ↑ EYE MUSCLES

HC062 oblique muscle (*n.*) One of a pair of muscles situated obliquely on the eyeball, to the left and right; they steady the eyeball in its up and down movement. ↑ EYE MUSCLES

HC063 tear (*n.*) See LACHRYMAL GLAND.

HC064 lachrymal gland (*n.*) (In land vertebrates) a gland at the outer or posterior corner of the eye; it continually secretes small amounts of a salty, sterile, slightly antiseptic liquid, called tears. The tears keep the cornea moist and wash foreign bodies out of the eye. The liquid drains through the lachrymal duct into the nose. In mammals, including man, the lachrymal gland is beneath the upper eyelid. ↑ TEAR

HC065 tear gland (*n.*) Alternative term for LACHRYMAL GLAND.

HC066 lachrymal duct (*n.*) See LACHRYMAL GLAND. ↑ TEAR

HC067 lacrimal duct (*n.*) Alternative term for LACHRYMAL DUCT. ↑ TEAR

HC068 lachrymal[2] (*adj.*) Of or to do with tears. ↓ LACHRYMATORY · LACRIMAL[2] ↑ EYELID

HC069 lachrymatory (*adj.*) Causing a much increased flow of tears. ↑ LACHRYMAL[2]

HC070 lacrimal[2] (*adj.*) Alternative term for LACHRYMAL[2] (↑).

HC071 crystalline lens (*n.*) A transparent structure, surrounded by a thin capsule, situated immediately behind the pupil of the vertebrate eye. In land vertebrates it has the shape of a biconvex lens; in fishes it is spherical. It is attached to the eyeball by suspensory ligaments. It refracts light onto the retina. ↓ CILIARY BODY · ACCOMMODATION · EYE DEFECT ↑ SIGHT

HC072 ciliary body (*n.*) A thickened circular structure at the edge of the choroid and at the border of the cornea. The iris and the suspensory ligaments are attached to it. It contains the ciliary muscle, used in accommodation. It secretes aqueous humour. ↓ CILIARY PROCESSES · CILIARY MUSCLE · SUSPENSORY LIGAMENT ↑ CRYSTALLINE LENS

HC073 ciliary processes (*n.pl.*) Ridges on the ciliary body to which the suspensory ligaments are attached. ↑ CILIARY BODY

HC074 ciliary muscle (*n.*) See CILIARY BODY (↑) and ACCOMMODATION (↓).

HC075 suspensory ligament (*n.*) A structure of collagen fibres, with one end of the fibre inserted in the capsule of the crystalline lens and the other end attached to the ciliary processes. ↑ CILIARY BODY

HC076 accommodation (*n.*) Adjusting the structures of the eye to bring an image into sharp focus on the retina. In vertebrates, the refractive media are: the cornea, the aqueous and vitreous humours, the crystalline lens. The lens produces the final sharp focus of the image on the retina. This is done in two ways, ***a*** by altering the curvature of the lens by contraction of the ciliary muscle, which relaxes the tension on the suspensory ligaments, allowing the lens to bulge and become more convex. When at rest, the ciliary muscles are relaxed, tension is maintained in the suspensory ligaments by the ciliary body, the lens is thin, and the eye is focussed on infinity. When viewing a near object, the ciliary muscles contract, tension is reduced on the suspensory ligaments, and the lens becomes fatter. This method of accommodation is found in man, some mammals, and in birds and reptiles. Few mammals can accommodate for near vision. ***b*** In fishes and amphibians, accommodation is effected by moving the lens forward to focus on near objects. In all vertebrates, focussing on near objects is assisted by constricting the pupil □ *the loss of accommodation in elderly people* —ACCOMMODATE (*v.*) ***accommodated*** (*adj.*) ↓ LENS[1] ↑ CRYSTALLINE LENS

HC077 lens[1] (*n.,pl.* **lenses**) An alternative term for CRYSTALLINE LENS (↑); the latter is more correct. ↑ ACCOMMODATION

HC078 eye defect (*n.*) A structural defect of the eye causing a defect in vision. The main defects are short sight, long sight, astigmatism, loss of accommodation and colour blindness. ↓ MYOPIA · SHORT SIGHT · HYPERMETROPIA · LONG SIGHT · ASTIGMATISM · LOSS OF ACCOMMODATION · COLOUR BLINDNESS ↑ CRYSTALLINE LENS

HC079 myopia (*n.*) The light from a distant image is brought to a focus in front of the retina. Only near objects can be focussed sharply, distant objects are blurred. Myopia is corrected by diverging lenses in spectacles. —***myopic*** (*adj.*) ↑ EYE DEFECT

HC080 short sight (*n.*) Alternative term for MYOPIA.

HC081 hypermetropia (*n.*) The light from a near object is brought to a focus behind the retina. Only distant objects can be focussed sharply; near objects are blurred. Hypermetropia is corrected by converging lenses in spectacles. —***hypermetropic*** (*adj.*) ↑ EYE DEFECT

HC082 long sight (*n.*) Alternative term for HYPERMETROPIA.

HC083 astigmatism (*n.*) Unequal curvature of the cornea produces unequal refraction of light entering the eye. The resulting focus is correct in one plane, but incorrect in other planes. The defect is corrected by a cylindrical lens. —***astigmatic*** (*adj.*) ↑ EYE DEFECT

HC084 loss of accommodation In older people, the crystalline lens loses its elasticity; when the ciliary muscles contract and tension on the lens slackens, the lens no longer bulges and near objects are not focussed sharply on the retina. The effect is similar to that of hypermetropia, and corrected in the same way. ↑ EYE DEFECT

HC085 colour blindness (*n.*) A defect in colour vision of man in which certain colours cannot be distinguished. A common type is red-green colour blindness, when red and green are not distinguished. A totally colour blind person sees only black, white and shades of grey. The defect is inherited and is genetically sex-linked. ↓ COLOUR VISION ↑ EYE DEFECT → SEX LINKAGE

HC086 retina (*n.*) The innermost layer lining the inside of the eyeball. It is composed of nervous tissue and does not cover the front region of the eyeball. It has a complex structure of three layers: an outer pigmented layer in contact with the choroid, an innermost layer of transparent nerve cells, and, between these two layers, a layer of photoreceptors consisting of rods and cones. The transparent layer consists of intermediary neurons, neuroglia, blood vessels and nerve fibres. The nerve fibres run over the surface of the retina and join the optic nerve. Light passes through the transparent layer, stimulates the photoreceptors, and impulses are conducted by the intermediary neurons and nerve fibres. This is called an inverted retina, as the photoreceptors are internal to the nerve fibres; it is found in all vertebrates. In cephalopods, the retina is not inverted, the photoreceptors being external to the nerve fibres. —***retinal*** (*adj.*) ↓ BLIND SPOT · ROD[2] ↑ SIGHT · EYEBALL

HC087 blind spot (*n.*) (In vertebrates) an area of the retina where the optic nerve enters the eyeball. At the blind spot there are neither rods nor cones, so light is not perceived at the area. ↓ OPTIC DISC · FOVEA CENTRALIS · FOVEA · MACULA[1] · MACULA LUTEA · YELLOW SPOT ↑ RETINA

HC088 optic disc (*n.*) Alternative term for BLIND SPOT.

HC089 fovea centralis (*n.*) A small, round depression in the centre of the posterior part of the retina of some vertebrates, containing numerous cones, but no rods. It is the region where light is mainly focussed and where there is the greatest acuity of vision. At the fovea there is no thick layer of nerve fibres, and no blood vessels, between the incoming light and the photoreceptors. It is found in lizards, diurnal birds and primates, including man. ↑ BLIND SPOT

HC090 fovea (*n.*) Alternative term for FOVEA CENTRALIS.

HC091 macula[1] (*n.,pl.* **maculae**) A small region at the posterior part of the retina; vision is relatively acute at the macula. It is found in many vertebrates, other than those possessing a fovea centralis. ↑ BLIND SPOT

HC092 macula lutea (*n.*) (In man and some primates) an oval area in the centre of the posterior part of the retina; it contains cells with a yellow pigment. The fovea centralis is situated at the centre of the macula lutea. ↑ BLIND SPOT · FOVEA CENTRALIS

HC093 yellow spot (*n.*) Alternative term for MACULA LUTEA.

HC094 rod[2] (*n.*) (In vertebrates) a rod-shaped type of photoreceptor in the retina. A rod is sensitive to dim light, is not sensitive to colour, and cannot distinguish fine detail. Rods are in greater concentration round the periphery of the retina. In a primate there are about 120 million rods in the retina. Rods contain visual purple. ↓ VISUAL PURPLE · VISUAL YELLOW · CONE[1] · COLOUR VISION ↑ RETINA → PHOTORECEPTOR

HC095 visual purple (*n.*) A reddish-purple pigment in retinal rods. The action of light changes it chemically to visual yellow and releases vitamin A (retinol). The chemical change provides energy for initiating a nerve impulse. Visual purple is resynthesized from visual yellow and vitamin A, hence vitamin A is essential for vision, particularly night vision. The amount of visual purple in the rods is increased in the dark, raising the sensitivity of the rods to dim light (a form of dark adaptation). ↑ ROD[2]

HC096 visual yellow (*n.*) A yellow pigment in insect eyes; see also VISUAL PURPLE. ↑ ROD[2] → COMPOUND EYE

HC097 cone[1] (*n.*) (In vertebrates) a type of photoreceptor in the retina. A cone is sensitive to colour, and is concerned with acuity of vision. The fovea centralis and macula contain very many small cones. In a primate there are about 6 million cones in the retina. There are few cones in the retina of nocturnal animals; bats have no cones at all. ↑ ROD[2]

HC098 colour vision (*n.*) The Young-Helmholtz theory of colour vision in man is widely accepted. It stipulates three different types of cones in the retina, one type being sensitive to blue light, one type to red light, and one type to green light. Red, green, and blue are the three primary colours; the same degree of stimulation to all three gives the sensation of white light. Colours are sensed by differential stimulus of each of the three types of cones. ↑ COLOUR BLINDNESS · ROD[2]

Hearing

HD001 hearing (*n.*) One of the senses of animals, concerned with the stimulus of sound. Hearing is well developed in tetrapod vertebrates, but poorly developed in fishes; it is well developed in insects but not in most other invertebrates. —***hear*** (*v.*) ↓ AUDIBILITY[2] · SCOLOPHORE · STATOCYST · LATERAL LINE SYSTEM · AUDIBLE[2] · EAR · MIDDLE EAR · INNER EAR · MEMBRANOUS LABYRINTH · COCHLEA → IRRITABILITY

HD002 audibility[2] (*n.*) The disposition of a sound to be detected □ *the threshold of audibility is the point at which an increasingly loud sound is just heard* ↑ HEARING

HD003 scolophore (*n.*) A complex auditory organ in the skin of insects. Several scolophores are in contact with an external tympanic membrane (the tympanum). A central, hollow, rod-like structure, a scolopale, is set in vibration by the

tympanum. The scolophore contains sensory cells which are stimulated by the vibrations, and nerve fibres send impulses to the auditory nerve. A scolophore detects frequencies higher than those perceived by the human ear. ↑ HEARING

HD004 scolopale (*n.*) See SCOLOPHORE.

HD005 statocyst (*n.*) (In some invertebrates) an organ of balance, consisting of a vesicle containing statoliths with sensory cells on the vesicle walls. Hair-like processes on the sensory cells are stimulated by the statoliths when the animal moves. ↓ OTIDIUM · OTOCYST · STATOLITH ↑ HEARING

HD006 otidium (*n.*) The statocyst of a mollusc. ↑ STATOCYST

HD007 otocyst (*n.*) Alternative term for a STATOCYST (↑).

HD008 statolith (*n.*) A small granule of limestone or sand, found in the statocysts of invertebrates. Also called an ***otolith***. ↑ STATOCYST

HD009 lateral line system (*n.*) (In fish and some amphibians) a system of sense organs arranged in a line along each side of the body, and in complicated patterns on the head. Sensory cells are situated in open grooves just beneath the surface of the skin, or in pores. Each cell has a hair-like process projecting into the groove or pore, and detects pressure changes and low frequency vibrations such as sounds of low pitch. The cells on the body form a lateral line, behind which, in the dermal tissues, lies a lateral line nerve supplied entirely by cranial nerves. The inner ear is probably a specialized part of the system. The system is better developed in bony fishes than in cartilaginous fishes. ↓ NEUROMAST · LATERAL LINE ORGAN · ACUSTICO-LATERALIS SYSTEM ↑ HEARING

HD010 neuromast (*n.*) The group of sensory cells in the lateral line system. ↑ LATERAL LINE SYSTEM

HD011 lateral line organ (*n.*) Alternative term for the LATERAL LINE SYSTEM (↑).

HD012 acustico-lateralis system (*n.*) Alternative term for the LATERAL LINE SYSTEM (↑).

HD013 audible[2] (*adj.*) Describes a sound that can be detected, particularly by a named agent, *e.g.* a very high-pitched whistle is audible to a dog, but not audible to a man □ *the drum was barely audible, but the gong was completely* or *quite audible* —AUDIBILITY (*n.*) ↓ AUDITORY · INAUDIBLE · ACOUSTIC[2] ↑ HEARING

HD014 auditory (*adj.*) **1** Describes structures in animals associated with the sense of hearing, *e.g.* the auditory nerve, the auditory organ. **2** Of or to do with the sense of hearing. ↑ AUDIBLE[2]

HD015 inaudible (*adj.*) Describes a sound that is not detected by auditory sense. ↑ AUDIBLE[2] (Ag)

HD016 acoustic[2] (*adj.*) Of or to do with sound, *e.g.* ***a*** a hearing aid is an acoustic device, as it amplifies sound for detection; ***b*** an acoustic pendulum detects sound waves. —ACOUSTICS (*n.*) ↑ AUDIBLE[2]

HD017 ear (*n.*) (In vertebrates) a sense organ for the detection of sound and the determination of balance of the body. The structure is more complex in mammals, and includes an outer, middle and inner ear, structures not always present in other vertebrates. ↓ OUTER EAR · OTIC · MIDDLE EAR · INNER EAR ↑ HEARING

HD018 outer ear (*n.*) **1** (In birds and mammals) the part of the ear external to the ear-drum; it consists of a short tube leading from the exterior to the ear-drum. **2** (In mammals) a flap of skin and cartilage surrounding the external opening of the ear. ↓ EXTERNAL AUDITORY MEATUS · PINNA[3] · AURICLE[2] ↑ EAR

HD019 external auditory meatus (*n.*) The tube or passage in the outer ear leading from the exterior to the ear-drum. ↑ OUTER EAR

HD020 pinna[3] (*n.*) (In mammals) the flap of skin and cartilage covering the opening to the external ear. In many mammals, it can be moved to assist in the detection of the direction of sound. ↑ OUTER EAR

HD021 auricle[2] (*n.*) **1** The outer ear of tetrapod vertebrates. **2** Any outgrowth or appendage like an ear. —***auricular*** (*adj.*) ↑ OUTER EAR

HD022 otic (*adj.*) Of or to do with the ear; the term describes the region of the auditory capsule, *e.g.* the otic ganglion on the mandibular nerve. ↑ EAR

HD023 middle ear (*n.*) (In most tetrapod vertebrates) the part of the ear consisting of: the ear-drum, an air-filled cavity between the ear-drum and the auditory capsule, a tube leading to the throat (eustachian tube), ear ossicles which cross the ear cavity. The middle ear is absent in fishes, newts, salamanders, and snakes—these animals can detect vibrations in the water or the ground by the vibrations being transmitted through their bodies to the inner ear. ↓ EAR-DRUM · TYMPANIC CAVITY · EAR OSSICLE · TYMPANIC ↑ HEARING

HD024 ear-drum (*n.*) A tough membrane covering the external opening of the middle ear of most tetrapod vertebrates; it consists of a double layer of epidermis with connective tissue between the layers. Sound waves cause it to vibrate. ↓ TYMPANUM · TYMPANIC MEMBRANE · TYMPANIC BONE ↑ MIDDLE EAR

HD025 tympanum (*n.*) **1** Alternative term for the MIDDLE EAR of vertebrates. **2** Alternative term for EAR-DRUM. **3** A membrane covering the auditory organ on the abdomen, metathorax, or leg, of insects. —TYMPANIC, TYMPANOID (*adj.*) ↑ EAR-DRUM · SCOLOPHORE

HD026 tympanic membrane (*n.*) Alternative term for EAR-DRUM (↑).

HD027 tympanic bone (*n.*) (In tetrapod vertebrates) the bone supporting the ear-drum. ↑ EAR-DRUM

HD028 tympanic cavity (*n.*) The air-filled cavity of the middle ear, excluding the eustachian tube. ↓ EUSTACHIAN TUBE · BULLA · TYMPANIC BULLA ↑ MIDDLE EAR

HD029 eustachian tube (*n.*) (In tetrapod vertebrates) a tube connecting the middle ear with the pharynx. Its function is to equalize air pressure between the middle ear and the outer ear, preventing distortion of the ear-drum. ↑ TYMPANIC CAVITY

HD030 bulla (*n.*) (In tetrapod vertebrates) a rounded projection of the skull enclosing the middle ear. ↑ TYMPANIC CAVITY

HD031 tympanic bulla (*n.*) Alternative term for BULLA.

HD032 ear ossicle (*n.*) (In tetrapod vertebrates) a small bone in the middle ear; one, two, or three ossicles connect the ear-drum with the auditory capsule. In amphibia and reptiles, there is a single ossicle, the columella auris. In birds, there are two ossicles, the columella and the stapes. In mammals, there are three ossicles, the malleus, incus, and stapes. The ossicle or ossicles transmit the vibrations of the ear-drum to the auditory capsule. The three ossicles in mammals form a system of levers which diminishes the amplitude of the sound waves and increases the force on the fenestra ovalis of the inner ear. ↓ MALLEUS · INCUS · STAPES · HAMMER · STIRRUP · ANVIL · COLUMELLA AURIS ↑ MIDDLE EAR

HD033 malleus (*n.*) (In mammals) the outer ear ossicle, in contact with the ear-drum and articulating with the incus. It represents a bone from the lower jaw of other vertebrates; its shape is similar to that of a hammer. ↑ EAR OSSICLE

HD034 incus (*n.*) (In mammals) the middle ear ossicle articulating with the malleus and the stapes; it represents a bone of the upper jaw of other vertebrates. ↑ EAR OSSICLE

HD035 stapes (*n.*) **1** (In birds and mammals) the inner ear ossicle in contact with the fenestra ovalis of the inner ear; in mammals it articulates with the incus, and in birds it articulates with the columella. **2** (In amphibia and reptiles) a small knob of cartilage on the distal end of the columella auris. ↑ EAR OSSICLE

HD036 hammer (*n.*) Alternative term for MALLEUS (↑).

HD037 stirrup (*n.*) Alternative term for STAPES (↑).

HD038 anvil (*n.*) Alternative term for INCUS (↑).

HD039 columella auris (*n.*) **1** (In reptiles and amphibians) a rod of bone or cartilage, an ear ossicle, connecting the ear-drum with the inner ear; it transmits vibrations from the ear-drum to the fenestra ovalis. **2** (In birds) an ear ossicle in contact with the ear-drum and articulating with the stapes. ↑ EAR OSSICLE

HD040 tympanic (*adj.*) To do with the tympanum. ↓ TYMPANOID ↑ MIDDLE EAR

HD041 tympanoid (*adj.*) Shaped like a drum. ↑ TYMPANIC

HD042 inner ear (*n.*) (In all vertebrates) the sense organ of hearing and of balance with respect to gravity and to body movement. Situated in the skull, it consists of a membranous labyrinth floating in a liquid contained in a bony labyrinth or auditory capsule; it is connected to the brain by the auditory nerve. The auditory capsule in fishes is connected to the exterior by a duct; the auditory capsule in amphibia and reptiles is connected to the middle ear by the fenestra ovalis, and in other vertebrates the bony labyrinth is connected to the exterior by two openings. ↓ AUDITORY CAPSULE · BONY LABYRINTH · MEMBRANOUS LABYRINTH · COCHLEA · FENESTRA OVALIS ↑ HEARING

HD043 auditory capsule (*n.*) (In fishes, amphibia and reptiles) a cartilaginous or bony cavity in the skull containing the membranous labyrinth; it contains perilymph, in which the labyrinth floats. It corresponds to the bony labyrinth in higher vertebrates. ↓ INTERNAL AUDITORY MEATUS · PERILYMPH ↑ INNER EAR

HD044 internal auditory meatus (*n.*) The bony canal through which runs the auditory nerve from the inner ear to the brain. ↑ AUDITORY CAPSULE

HD045 perilymph (*n.*) The liquid separating the membranous labyrinth from the auditory capsule or bony labyrinth. It is identical in composition with cerebrospinal fluid. Its function is to absorb external mechanical shocks and to protect the delicate sense organs; it also conducts vibrations transmitted from the middle ear. ↓ ENDOLYMPH ↑ AUDITORY CAPSULE

HD046 bony labyrinth (*n.*) (In birds and mammals) a labyrinth consisting of three cavities; the vestibule, the cochlea, and the semi-circular canals. The cavities are hollowed out of bone, lined with periostium and contain perilymph. In man, the vestibule is about 5 mm long and 3 mm broad. The membranous labyrinth is situated in the bony labyrinth and connected to it at different points by fibrous bands. ↓ VESTIBULE[3] · OSSEOUS LABYRINTH · SEMI-CIRCULAR CANAL · COCHLEA ↑ INNER EAR

HD047 vestibule[3] (*n.*) A cavity in the bony labyrinth which contains the sacculus and the utriculus. —***vestibular*** (*adj.*) ↑ BONY LABYRINTH

HD048 osseous labyrinth (*n.*) Alternative term for BONY LABYRINTH (↑).

HD049 membranous labyrinth (*n.*) A complex structure consisting of two connected sacs containing otoliths. From each sac arise other structures, differing in different groups of vertebrates, concerned with the sense of hearing and the sense of balance and position. The membranous labyrinth contains a liquid (endolymph); it floats in another liquid (perilymph), and is fastened to the auditory capsule or bony labyrinth by fibrous bands. It is smaller, but of similar shape to a bony labyrinth. ↓ SACCULUS[2] · OTOLITH · SEMI-CIRCULAR CANAL ↑ HEARING · INNER EAR

HD050 sacculus[2] (*n.*) A small bag-shaped sac, situated in the ventral part of the vestibule; it is connected to the utriculus, and filled with endolymph In fishes, sensory

patches on the wall of the sacculus respond to stimuli of vibrations in the water which are transmitted by the body, *i.e.* a primitive, and poorly developed, sense of hearing. The sacculus is connected to the exterior by a tube, the aqueductus vestibuli. In other vertebrates, similar sensory patches are associated with a sense of static position. In amphibians and reptiles, a small sac, the lagena, projects from the sacculus. In birds and mammals, a cochlea projects from the sacculus. ↓ UTRICULUS · LAGENA · SACCULE[2] · UTRICLE[2] · MACULA[2] · ENDOLYMPH ↑ MEMBRANOUS LABYRINTH

HD051 utriculus (*n.*) A bag-shaped sac, larger than the sacculus, situated in the dorsal part of the vestibule; it is connected to the sacculus and filled with endolymph. In all vertebrates, three semi-circular canals arise from the utriculus. ↑ SACCULUS[2]

HD052 lagena (*n.*) **1** (In amphibians and reptiles) a small sac projecting from the sacculus, and concerned with the sense of hearing; it corresponds to the cochlear duct of mammals. In other tetrapod vertebrates, it is the end part at the apex of the cochlea. **2** The cochlea of birds. ↑ SACCULUS[2]

HD053 saccule[2] (*n.*) Alternative term for SACCULUS[2] (↑).

HD054 utricle[2] (*n.*) Alternative term for UTRICULUS (↑). ↑ SACCULUS[2]

HD055 macula[2] (*n.,pl.* **maculae**) Patches of sensory hair cells with supporting cells, on the walls of the sacculus and the utriculus. Otoliths weigh down on the macula and continuous impulses are conducted by the auditory nerve to the brain. These impulses are interpreted as a sense of static position. ↓ CRISTA[2] ↑ SACCULUS[2]

HD056 endolymph (*n.*) The liquid in the membranous labyrinth. Currents arise in endolymph when the head or body moves; sensory cells detect the currents and impulses from the cells are interpreted for a sense of balance. The endolymph also transmits vibrations for the detection of sound. ↑ SACCULUS[2] · PERILYMPH

HD057 otolith (*n.*) **1** Small granules of calcium carbonate in the membranous labyrinth. Some are attached to the hair-like processes of sensory cells, others are free to move. Under the influence of gravity, those free to move settle on sensory cells and the stimulus received by the cell initiates a nervous impulse which is conducted by the auditory nerve to the brain, where it is interpreted as the position of the animal with respect to gravity. When moved by currents in the endolymph of the membranous labyrinth, otoliths in the ampulla detect angular movement. **2** See STATOLITH. ↓ OTOCONIUM · EAR SAND ↑ MEMBRANOUS LABYRINTH · STATOLITH

HD058 otoconium (*n.,pl.* **otoconia**) A very small crystal of calcium carbonate performing the same function as an otolith. ↑ OTOLITH

HD059 ear sand (*n.*) Alternative term for OTOCONIA ↑ OTOLITH

HD060 semi-circular canal (*n.*) One of the three semi-circular tubes found in each bony labyrinth in most vertebrates, each connected at both ends to the utriculus. All three are mutually at right angles to each other, occupying the three planes of space. Two are vertical, at right angles to one another, and the third is horizontal. All three tubes contain endolymph and any angular movement of the body produces currents in the endolymph of the corresponding canal or canals. Hairs protruding from sensory cells detect the current in the endolymph and initiate nervous impulses which are conducted by the auditory nerve to the brain. Each semi-circular canal has a swelling (an ampulla) at one end. ↓ AMPULLA · CRISTA[2] · CUPULA · CRISTA ACUSTICA ↑ MEMBRANOUS LABYRINTH

HD061 ampulla (*n.*) The dilated portion or swelling at the end of a semi-circular canal. It contains otoliths attached to fine hair-like processes of sensory cells. Turning movements of the head or body cause currents in the endolymph of the semi-circular canals and the currents are detected by the sensory cells. ↑ SEMI-CIRCULAR CANAL

HD062 crista[2] (*n.,pl.* **cristae**) A ridge of sensory cells, with supporting cells, in the ampulla; it is connected to the auditory nerve; its function is to detect angular movement or acceleration. ↑ SEMI-CIRCULAR CANAL

HD063 cupula (*n.*) A dome-shaped, gelatinous mass covering the crista in ampulla; it is free to move with currents in the endolymph and stimulates the sensory cells in the crista. ↑ SEMI-CIRCULAR CANAL

HD064 crista acustica (*n.*) Alternative and strictly more correct term for CRISTA[2] (↑).

HD065 cochlea (*n.*) The anterior part of the bony labyrinth in birds and mammals; in mammals, it is a tube coiled in the shape of the shell of a snail; in birds, it is long and curved. It contains the cochlear duct joined to the spiral lamina; these two structures divide the cochlea into two canals, the vestibular canal and the tympanic canal, which communicate with each other through a small opening at the apex of the cochlea. Both canals are filled with perilymph. The vestibular canal is connected to the middle ear by the fenestra ovalis; the tympanic canal is connected to the middle ear by the fenestra rotunda. Vibrations from the fenestra ovalis travel through the perilymph up the vestibular canal, down the tympanic canal and are transmitted to the fenestra rotunda. ↓ MODIOLUS · FENESTRA OVALIS · COCHLEAR DUCT ↑ HEARING · MEMBRANOUS LABYRINTH · INNER EAR

HD066 modiolus (*n.*) The conical central axis of the cochlea; the spiral tube of the cochlea makes two and three-quarter turns round the modiolus. It is broad at the base, which is situated at the bottom of the internal auditory meatus, and narrows to a point. It carries the cochlear nerve. ↓ SPIRAL LAMINA · BASILAR MEMBRANE · VESTIBULAR

CANAL · TYMPANIC CANAL · SCALA VESTIBULI · SCALA TYMPANI ↑ COCHLEA

HD067 spiral lamina (*n.*) A delicate bony lamina which projects from the modiolus into the tube of the cochlea, reaching about halfway across. It carries branches of the cochlear nerve to the organ of Corti. ↓ CORTI'S ORGAN ↑ MODIOLUS

HD068 basilar membrane (*n.*) A membrane stretching across the cochlea. The outer edge is connected to the outside wall of the cochlea; the inner edge is connected to the spiral lamina. ↑ MODIOLUS

HD069 vestibular canal (*n.*) See COCHLEA.

HD070 tympanic canal (*n.*) See COCHLEA.

HD071 scala vestibuli (*n.*) Alternative term for VESTIBULAR CANAL; see also COCHLEA. ↑ COCHLEA · MODIOLUS

HD072 scala tympani (*n.*) Alternative term for TYMPANIC CANAL; see also COCHLEA. ↑ COCHLEA · MODIOLUS

HD073 fenestra ovalis (*n.*) An opening in the wall of the auditory capsule or the bony labyrinth; it is covered by the base of the stapes or by the base of the columella auris and a thin membrane is stretched across the opening. In mammals and birds, it connects with the cochlea of the bony labyrinth, so that vibrations transmitted by the stapes are conducted by the perilymph. In amphibians and reptiles, it is the only connection between the middle ear and the auditory capsule. It does not occur in fishes. ↓ FENESTRA ROTUNDA · FENESTRA VESTIBULI · OVAL WINDOW · ROUND WINDOW ↑ COCHLEA

HD074 fenestra rotunda (*n.*) A small aperture in the inner wall of the tympanic cavity; it connects the cochlea to the tympanic cavity and is covered by a thin membrane. Its function is to allow the exit of sound vibrations which have entered the cochlea by the fenestra ovalis. ↑ FENESTRA OVALIS

HD075 fenestra vestibuli (*n.*) Alternative term for the FENESTRA OVALIS in mammals.

HD076 oval window (*n.*) Alternative term for the FENESTRA OVALIS.

HD077 round window (*n.*) Alternative term for FENESTRA ROTUNDA.

HD078 cochlear duct (*n.*) An outgrowth of the sacculus; it contains endolymph. The roof is the vestibular membrane; the floor is the basilar membrane; the wall is the wall of the cochlea, and it is triangular in shape. It runs almost the length of the cochlea and ends blindly. Vibrations in the perilymph of the vestibular canal cause vibrations in the endolymph of the cochlear duct. ↓ VESTIBULAR MEMBRANE · CORTI'S ORGAN · COCHLEAR CANAL · ORGAN OF CORTI ↑ COCHLEA

HD079 vestibular membrane (*n.*) See COCHLEAR DUCT.

HD080 Corti's organ (*n.*) Consists of hair cells, and supporting cells, situated on the basilar membrane. Vibrations in the endolymph of the cochlear duct cause the basilar membrane to vibrate, which in turn causes the hair cells to vibrate. Certain parts of Corti's organ respond to certain frequencies of vibration; these parts then send nervous impulses along the cochlear nerve, and the brain interprets the sensation as the pitch of the original sound waves. ↑ COCHLEAR DUCT

HD081 cochlear canal (*n.*) Alternative term for the COCHLEAR DUCT (↑).

HD082 organ of Corti (*n.*) Alternative term for CORTI'S ORGAN (↑).

Sense Organs

HE001 smell (*n.*) The sense stimulated by gases and vapours; also known as the ***olfactory sense***. Certain gases and vapours stimulate the olfactory organs, and impulses conducted by the olfactory nerve are interpreted as the sense of smell. —***smell*** (*v.*) ↓ OLFACTORY ORGAN · ODOUR · OLFACTORY · ODORIFEROUS · NOSE → IRRITABILITY

HE002 olfactory organ (*n.*) In arthropods, the olfactory organs are small exposed chemoreceptors at the bottom of small pits, located on the antennae. In fishes, there are a pair of large chambers with folded spongy walls, which contain chemoreceptors. In tetrapod vertebrates, an olfactory surface of epithelium, containing supporting cells and chemoreceptors, is situated in a nasal cavity. The chemoreceptors are surrounded by glands secreting mucus. The gases and vapours dissolve in the mucus, and are detected by the chemoreceptors which initiate impulses conducted by the olfactory nerve to the brain. The olfactory organ is also associated with the sense of taste in detecting flavour. ↓ CHEMORECEPTOR ↑ SMELL → OLFACTORY LOBE · OLFACTORY NERVE · TASTE

HE003 chemoreceptor (*n.*) A receptor stimulated by substances in solution; it detects differences in chemical structure by contact with molecules in solution, *e.g.* sensory cells of smell and taste. ↑ OLFACTORY ORGAN → RECEPTOR

HE004 odour (*n.*) The property of a substance which is perceived by smell. When qualified by a suitable adjective the term means a group of similar olfactory experiences, *e.g.* a pungent odour; a sharp odour □ *chlorine has a distinctive odour* —***odourless,*** MALODOROUS (*adj.*) ↑ SMELL

HE005 olfactory (*adj.*) Of or to do with the sense of smell. ↑ SMELL

HE006 odoriferous (*adj.*) Describes an object or material which produces an odour.

e.g. *a* sweat is odoriferous; *b* the nectar of some flowers is odoriferous. ↓ MALODOROUS · FRAGRANT · ACRID · PUNGENT · CHOKING · ODOURLESS ↑ SMELL

HE007 malodorous (*adj.*) Describes an object with a bad smell; unpleasant to the senses. ↑ ODORIFEROUS

HE008 fragrant (*adj.*) Describes an odour which is pleasant to the senses, *e.g.* many flowers have a fragrant odour. ↑ ODORIFEROUS

HE009 acrid (*adj.*) Describes any odour which resembles the odour of wood smoke. ↑ ODORIFEROUS

HE010 pungent (*adj.*) Describes an odour with a strong effect on the olfactory organs, or the taste of food with a similar effect, *e.g.* the odour of vinegar. ↑ ODORIFEROUS

HE011 choking (*adj.*) Describes an odour, stronger than acrid, felt at the back of the throat, *e.g.* the smell of hydrogen chloride. ↑ ODORIFEROUS

HE012 odourless (*adj.*) Describes an object or material which is entirely without odour, *e.g.* water is odourless. ↑ ODORIFEROUS

HE013 nose (*n.*) A prominent structure on the front of the face of mammals; it contains two holes, the nostrils, used for breathing and smelling. The use of the term is sometimes restricted to human beings. —***nasal*** (*adj.*) ↓ SNOUT (Sn) · NASAL CAVITY · SINUSITIS ↑ SMELL

HE014 snout (*n.*) A long, projecting nose, pointing forwards, as on a dog. The adjective, ***nasal***, is used concerning both the terms nose and snout. ↓ NOSTRIL · NARES · CHOANA ↑ NOSE (Sn)

HE015 nostril (*n.*) One of the paired openings in a nose or snout, leading to the nasal cavity. ↑ SNOUT

HE016 nares (*n.pl., sing.* **naris**)In vertebrates, paired openings on the surface of the head, leading to the nasal cavity or nasal chambers, are **external** nares. **Internal** nares connect the nasal cavity to the mouth or pharynx. Most fishes have external nares only, but lung-fishes, and all other vertebrates, have internal nares. The external nares are called nostrils if the animal has a nose or snout, *e.g.* birds have nares, but dogs have nostrils, which can also be called nares. —***narial*** (*adj.*) ↑ SNOUT · NOSTRIL (H)

HE017 choana (*n.,pl.* **choanae**) (In tetrapod vertebrates) the internal nares. In crocodiles and mammals it leads into the pharynx, in other vertebrates into the front part of the buccal cavity. ↑ SNOUT

HE018 nasal cavity (*n.*) (In tetrapod vertebrates) a cavity lined with sensory mucous membrane connected to the exterior and to the buccal cavity by nares. In crocodiles and mammals, the cavity is extended by the false palate. ↓ CONCHA · NASAL SINUS ↑ NOSE

HE019 concha (*n.*) A bony projection from the lateral walls of the nasal cavity; it increases the surface area of the sensory epithelium. ↑ NASAL CAVITY

HE020 nasal sinus (*n.,pl.* **nasal sinuses**) (In mammals) one of many air-filled cavities lined with mucous membrane which are found in the bones of the nose and skull, all interconnecting and communicating with the nasal cavity. ↑ NOSE

HE021 sinusitis (*n.*) Inflammation of the nasal sinuses. ↑ NASAL SINUS

HE022 touch (*n.*) The sense stimulated by contact with material substances; it is well developed in all animals. Different receptors respond to different stimuli such as contact, pain, warmth, and cold. ↓ TACTILE CORPUSCLE ↑ IRRITABILITY

HE023 tactile corpuscle (*n.*) The encapsulated end-organ of touch, located immediately below the epidermis of animals. ↓ RHEORECEPTOR · END-BULB ↑ TOUCH

HE024 rheoreceptor (*n.*) (In some invertebrates, fishes, and some amphibia) one of the cutaneous sense organs which detect currents in water, *e.g.* the lateral line organs of fish are rheoreceptors. ↑ TACTILE CORPUSCLE → CUTANEOUS · RECEPTOR

HE025 end-bulb (*n.*) (In vertebrates) a nerve ending in the shape of a bulb; a receptor for sensation of cold. ↑ TACTILE CORPUSCLE

HE026 neurology (*n.*) The study of the morphology, physiology and pathology of nerves and the nervous system. ↓ NEURITIS → IRRITABILITY

HE027 neuritis (*n.*) Inflammation of a nerve. ↓ NEURALGIA · NEURASTHENIA

HE028 neuralgia (*n.*) (In a nerve) a sharp pain which is not caused by damage to the nerve structure. ↑ NEURITIS

HE029 neurasthenia (*n.*) A condition of ill-health with symptoms of tiredness, pains in the head, malfunctioning of the digestive system, and inability to rest and sleep. Considered to be caused by mental troubles. ↑ NEURITIS

Endocrinology

JA001 ductless glands (*n.pl.*) These glands vary considerably in size; all contain glandular epithelium, and all are without ducts. The glandular secretions (hormones) diffuse into the blood and are carried through the vascular system to their site of action. Also called ***endocrine glands***. ↓ ENDROCRINE GLAND · THYROID GLAND · CORPUS ALLATUM · GIGANTISM · HORMONE · GASTROINTESTINAL HORMONES · GONADOTROPIN · PHYTO-

HORMONES → PITUITARY GLAND · PANCREAS · HYPOTHALAMUS · THYMUS

JA002 endocrine gland (*n.*) Alternative term for DUCTLESS GLAND. ↓ ENDOCRINE SYSTEM ↑ DUCTLESS GLAND

JA003 endocrine system (*n.*) All the endocrine glands of an animal, together with the interactions of their hormones, form an endocrine system, *e.g.* excess secretion of adrenalin inhibits the pituitary gland secreting TH; TH promotes the secretion of thyroxin. Most of the endocrine glands interact in this way, finally forming a mechanism for hormonal control, based on feed-back mechanisms. ↑ ENDOCRINE GLAND

JA004 thyroid gland (*n.*) (In tetrapod vertebrates) a single, ductless, highly vascular gland in front of the larynx, homologous with the endostyle of amphioxus and ammocoetes. It secretes thyroxin and thyroglobulin, both iodine-containing substances; secretion is controlled by a thyrotropic hormone. Lack of iodine in the diet causes enlargement (hyperplasia) of the gland, resulting in simple goitre. In human beings, hypofunction of the gland produces cretinism in infants and myxoedema in adults; hyperfunction of the gland produces exophthalmic goitre. In amphibians, the gland is paired and thyroid secretion controls metamorphosis. ↓ PARATHYROID GLAND · ADRENAL GLAND · SUPRARENAL GLAND · ADRENAL CORTEX · ADRENAL MEDULLA · THYROGLOBULIN · MYXOEDEMA ↑ DUCTLESS GLAND

JA005 parathyroid gland (*n.*) (In tetrapod vertebrates) a small, brownish, ductless gland, lying in or near the thyroid gland. In many vertebrates it is paired; in man there are four glands. The glands secrete parathormone. ↓ PARATHORMONE ↑ THYROID GLAND

JA006 adrenal gland (*n.*) In mammals, one of a pair of glands situated one on each kidney; in other vertebrates there are multiple glands. Each gland has two parts: an inner part, the **medulla**, derived from nervous tissue, and an outer part, the **cortex**, derived from the lining of the coelom. The medulla secretes adrenalin and noradrenalin and is controlled by the sympathetic nervous sytem and adrenotropic hormone. The cortex secretes steroid hormones of three types, *a* glucocorticoids; *b* mineralocorticoids; *c* sex hormones; cortical hormone secretion is mainly controlled by ACTH. ↓ GLUCOCORTICOIDS · MINERALOCORTICOIDS · ADRENALIN · NORADRENALIN · ADRENOTROPIC HORMONE · ACTH ↑ THYROID GLAND

JA007 suprarenal gland (*n.*) Alternative term for ADRENAL GLAND.

JA008 adrenal cortex (*n.*) In mammals, the outer part of the adrenal gland; it is indispensable for life In non-mammalian vertebrates, medullary and cortical tissues of the adrenal gland are differently arranged; in some fishes the adrenal cortex and the adrenal medulla are separated into distinct organs. ↑ THYROID GLAND

JA009 adrenal medulla (*n.*) In mammals, the inner part of the adrenal gland; it is dispensable as it is not necessary for quiet circumstances, because it seems to have mainly an emergency function. ↑ THYROID GLAND

JA010 corpus allatum (*n.,pl.* **corpora allata**) One of the paired, whitish, ductless glands in the head of an insect. The glands produce hormones which control the process of development to sexual maturity. ↑ DUCTLESS GLANDS

JA011 corpora allata (*n.pl.*) Plural form of corpus allatum. ↑ CORPUS ALLATUM

JA012 gigantism (*n.*) A disease caused by enlargement of the anterior lobe of the pituitary gland, leading to hyperfunction. Long bones are greatly increased in length and the person becomes abnormally tall; mental ability is usually very low and after adolescence there is a loss of sexual capacity. Also called ***giantism.*** ↓ ACROMEGALY · DWARFISM (An) ↑ DUCTLESS GLANDS

JA013 acromegaly (*n.*) A diseased condition caused by hypertrophy of the anterior lobe of the pituitary gland in adults. A gradual enlargement and thickening of the bones in hands, feet, and face, takes place. ↑ GIGANTISM

JA014 hormone (*n.*) A substance produced in minute quantities in cells in one part of an organism, and transported in the vascular system to another, distant part where it is either essential for or has an important effect on the proper functioning of the cells in that part. In animals, hormones are produced by ductless glands; in plants, they are internal secretions of cells. ↓ ENDOCRINOLOGY · SOMATOTROPIC HORMONE · ANTIDIURETIC HORMONE · ADRENALIN · DWARFISM · THYROTROPIC HORMONE ↑ DUCTLESS GLANDS

JA015 endocrinology (*n.*) The study of hormones; it includes their production, chemical constitution, properties, and effects. ↓ HORMONE BALANCE ↑ HORMONE

JA016 hormone balance (*n.*) Excess production of a hormone usually activates a mechanism to reduce this production; this is known as feed-back, *e.g.* excess secretion of adrenalin inhibits the secretion of adrenotropic hormone by the pituitary gland. Adrenotropic hormone promotes the secretion of adrenalin by the medulla of the adrenal gland, so an excess of adrenalin activates a mechanism which lessens the production of adrenalin. This provides an effective control mechanism. A complex system of hormone balance exists between all hormones as a result of similar feedback systems. ↑ ENDOCRINOLOGY

JA017 somatotropic hormone (*n.*) (In vertebrates) a hormone secreted by the anterior lobe of the pituitary gland; it is a globulin. It affects specifically protein metabolism, and stimulates true growth. An excess of the hormone causes gigantism and

acromegaly; a deficiency of the hormone causes dwarfism. ↓ THYROXIN · THYROGLOBULIN · GLUCOCORTICOIDS · CORTISONE · GROWTH HORMONE · STH ↑ HORMONE → INSULIN · GLUCAGON

JA018 thyroxin (*n.*) *or* **thyroxine** An amino-acid containing iodine; it is secreted by the thyroid gland. Its function is to increase the rate of oxidation of metabolites, and hence the rate of cellular metabolism; because of this action, it has a considerable effect on growth and differentiation of animal tissues, particularly skeletal and nervous tissues. Insufficiency and excess of thyroxin both cause clinical disease. ↓ EXOPHTHALMIC GOITRE ↑ THYROID GLAND · SOMATROPIC HORMONE → AMINO ACID[2]

JA019 thyroglobulin (*n.*) A protein containing thyroxin; it is the chemical form in which thyroxin is stored in the thyroid gland. It is also secreted with thyroxin, in varying proportions in different species of vertebrates. ↑ SOMATOTROPIC HORMONE

JA020 glucocorticoids (*n.pl.*) In vertebrates, a number of hormones secreted by the adrenal cortex. Their function is to regulate the intermediary steps in the metabolism of carbohydrates and proteins; they are antagonistic to insulin in that they raise the concentration of glucose in blood plasma by converting glycogen in the liver to glucose. ↑ SOMATOTROPIC HORMONE · ADRENAL CORTEX

JA021 cortisone (*n.*) One of the glucocorticoids; it has complex functions concerned with cell metabolism, and in particular diminishes local inflammation and promotes healing of wounds; it is used to treat rheumatoid arthritis. ↑ SOMATROPIC HORMONE

JA022 growth hormone (*n.*) Alternative term for SOMATOTROPIC HORMONE.

JA023 STH (*abbr.*) Abbreviation for SOMATOTROPIC HORMONE.

JA024 antidiuretic hormone (*n.*) (In mammals) a hormone secreted by the hypothalamus and stored in the posterior lobe of the pituitary gland. Its function is to stimulate water reabsorption by uriniferous tubules; this reduces the volume of urine formed. A deficiency of the hormone causes ***diabetes insipidus***. Secretion of the hormone is related to the osmotic pressure of the blood plasma. The hormone also causes constriction of arterioles and capillaries, raising the blood pressure. ↓ PARATHORMONE · MINERALOCORTICOIDS · ADH · PARATHYRIN ↑ HORMONE → DIABETES INSIPIDUS

JA025 parathormone (*n.*) (In tetrapod vertebrates) a hormone secreted by the parathyroid gland; it controls the concentration of calcium ions and of phosphate ions in the blood. A deficiency of the hormone lowers the calcium concentration in the blood and causes tetany. An excess of the hormone raises the calcium concentration in the blood and causes deossification of bone. ↑ ANTIDIURETIC HORMONE → TETANY

JA026 mineralocorticoids (*n.pl.*) Hormones secreted by the cortex of the adrenal glands. Their function is to control the concentration of mineral ions in blood plasma, lymph, and tissue fluid, especially the balance of sodium chloride and water in these liquids. ↑ ANTIDIURETIC HORMONE

JA027 ADH (*abbr.*) Abbreviation for ANTIDIURETIC HORMONE.

JA028 parathyrin (*n.*) Alternative term for PARATHORMONE.

JA029 adrenalin (*n.*) or **adrenaline** (In vertebrates) a secretion of the medulla of the adrenal gland. Its functions include: constriction of visceral blood vessels; increased heart beat; raising the concentration of glucose in blood; dilation of blood vessels of heart, brain, and muscles; dilation of eye pupil; erection of hair; dilation of bronchioles. Secretion of adrenalin is stimulated by nervous impulses from the brain originating in strong emotions such as fear, rage, etc. The action of adrenalin reinforces and prolongs the action of the sympathetic nervous system, and raises the efficiency of body functions. Adrenalin is also secreted by some invertebrates. ↓ NORADRENALIN · PITUITRIN · VASOPRESSIN · OXYTOCIN · INTERMEDIN · PITRESSIN ↑ HORMONE

JA030 noradrenalin (*n.*) The precursor of adrenalin; secreted together with adrenalin, the relative amounts of the two substances varying among different vertebrate species. Its function is similar to adrenalin, but not identical. Both adrenalin and noradrenalin are secreted by many nerve endings of the sympathetic nerves. Noradrenalin is also secreted by some invertebrates. ↑ ADRENALIN

JA031 pituitrin (*n.*) A commercial substance extracted from the posterior lobe of the pituitary gland; it contains vasopressin and oxytocin, separated in two fractions from the original substance. ↓ VASOPRESSIN · OXYTOCIN ↑ ADRENALIN

JA032 vasopressin (*n.*) One fraction of the extract of pituitrin; a hormone which, when injected, causes constriction of arterioles and capillaries (raising the blood pressure) and a reduction in the volume of urine. The action of the hormone is identical with that of ADH. Vasopressin is obtained from cattle and the animal hormone has a slightly different structure from the human hormone, ADH. Vasopressin is used to describe the commercial preparation. ↑ ADRENALIN · PITUITRIN

JA033 oxytocin (*n.*) One fraction of the extract of pituitrin; a hormone which increases the tonus of the uterine muscles, causing strong contractions. ↑ ADRENALIN → TONUS[2]

JA034 intermedin (*n.*) (In vertebrates) a hormone secreted by the pars intermedia of the pituitary gland. In fishes, amphibians, and reptiles, it disperses pigment granules in chromatophores and effects a change in colour of the skin; not secreted by birds and some mammals. ↑ ADRENALIN

JA035 pitressin (*n.*) Alternative term for VASOPRESSIN

JA036 dwarfism (*n.*) A diseased condition caused by deficiency of somatotropic hormone (STH) in the young. Growth is retarded and the sexual organs usually fail to mature. ↓ CRETINISM · MYXOEDEMA · MYXEDEMA · EXOPHTHALMIC GOITRE

JA037 cretinism (*n.*) A diseased condition caused by insufficiency of thyroxin in childhood. Development of the body and mental abilities ceases at an early age, and the adolescent child resembles a young child in all characteristics. —***cretin*** (*n.*) ↑ DWARFISM

JA038 myxoedema (*n.*) A diseased condition caused by insufficiency of thyroxin in adults. The signs and symptoms include obesity and a slowness in mental processes. ↑ THYROXIN · DWARFISM

JA039 myxedema (*n.*) Alternative term for MYXOEDEMA.

JA040 exophthalmic goitre (*n.*) A disease caused by oversecretion of thyroxin; the patient is excitable, suffers from insomnia and has protuberant eyeballs. ↑ DWARFISM

JA041 thyrotropic hormone (*n.*) (In vertebrates) a hormone secreted by the anterior lobe of the pituitary gland. It promotes secretion of thyroxin by the thyroid gland; large doses of the hormone administered by injection can stimulate growth of the thyroid gland. ↓ ADRENOTROPIC HORMONE · ACTH · ADRENOCORTICOTROPHIC HORMONE · ADRENOCORTICOTROPIC HORMONE · TH ↑ HORMONE

JA042 adrenotropic hormone (*n.*) (In vertebrates) a hormone secreted by the posterior lobe of the pituitary gland. Its function is to control the action of the adrenal medulla. ↑ THYROTROPIC HORMONE

JA043 ACTH (*abbr.*) (In vertebrates) a hormone secreted by the anterior lobe of the pituitary gland. Its function is to control the production by the adrenal cortex of cortisone and other glucocorticoids. ↑ THYROTROPIC HORMONE

JA044 adrenocorticotrophic hormone (*n.*) Alternative term for ACTH.

JA045 adrenocorticotropic hormone (*n.*) Alternative term for ACTH.

JA046 TH (*abbr.*) Abbreviation for THYROTROPIC HORMONE (↑).

JA047 gastrointestinal hormones (*n.pl.*) The variety of hormones secreted by the epithelium of different parts of the alimentary canal. Most of them promote the secretion of digestive juices or activate associated parts of the alimentary canal. ↓ SECRETIN ↑ DUCTLESS GLANDS

JA048 secretin (*n.*) (In vertebrates) a hormone secreted by the epithelium of the duodenum and jejenum; it is a peptide. Secretion is promoted by acidic chyme from the stomach. The hormone promotes the production of pancreatic juice and the secretion of bile. ↓ GASTRIN ↑ GASTROINTESTINAL HORMONES → CHYME

JA049 gastrin (*n.*) (In vertebrates) a hormone secreted by the epithelium of the stomach wall. It induces the secretion of gastric juice. ↑ SECRETIN

JA050 gonadotropin (*n.*) Any hormone affecting gonads. ↓ ANDROGEN · FOLLICLE-STIMULATING HORMONE · FSH · GONADOTROPIC ↑ DUCTLESS GLANDS → GONAD

JA051 androgen (*n.*) (In vertebrates) any hormone promoting the development and maintenance of male sexual characteristics. Such substances are steroids, secreted mainly by testes, but sometimes to a small extent by ovaries and the adrenal cortex. ↓ TESTOSTERONE ↑ GONADOTROPIN → TESTES

JA052 testosterone (*n.*) (In vertebrates) a hormone secreted by the testis. It is an androgen. ↑ ANDROGEN

JA053 follicle-stimulating hormone (*n.*) (In vertebrates) a hormone secreted by the anterior lobe of the pituitary gland. Its function is gonadotropic; it stimulates growth of ovarian follicles and of their oocytes in the ovaries of females and stimulates the formation of spermatozoa in the testes of males. It also promotes the production of oestrogens. ↓ LUTEINIZING HORMONE · OESTROGEN · OESTRADIOL · PROLACTIN · PROGESTERONE · PROGESTOGEN ↑ GONADOTROPIN

JA054 luteinizing hormone (*n.*) (In vertebrates) a hormone secreted by the anterior lobe of the pituitary gland. In females, it controls secretion of oestrogenic hormones, promotes the final development of ovarian follicles and causes ovulation; in female mammals, it initiates development of the corpus luteum. In males, it controls secretion of testosterone and promotes the formation of spermatozoa; in some vertebrates, it promotes the transfer of spermatozoa from testes to ducts. ↑ FOLLICLE-STIMULATING HORMONE → CORPUS LUTEUM

JA055 oestrogen (*n.*) Any substance which induces oestrus in vertebrates; it can be a naturally-occurring hormone, or a synthetic compound; also called ***follicular hormones***. ↑ FOLLICLE-STIMULATING HORMONE → OESTRUS

JA056 oestradiol (*n.*) The chief oestrogenic hormone produced by the ovary; it is a steroid. Its functions include the development of many secondary sexual characteristics of females and the thickening of the uterine lining. ↑ FOLLICLE-STIMULATING HORMONE → UTERINE

JA057 prolactin (*n.*) (In vertebrates) a hormone secreted by the anterior lobe of the pituitary gland; it has more than 60 functions, the more important of which are as follows. In female mammals, it promotes the secretion of progesterone by the corpus luteum and, together with other hormones, causes the secretion of milk in the mammary glands; this is its most important function in mammals. In the lower vertebrates and in mammals, it is involved with the movement of sodium ions across membranes, gills, gut and bladder. In pigeons, it promotes the production of crop-milk. In certain teleosts it maintains the sodium ion concentration in plasma when the fish is in fresh water. ↑ FOLLICLE-STIMULATING HORMONE → MAMMARY GLAND · CROP-MILK

JA058 progesterone (*n.*) (In mammals) a steroid secreted by the corpus luteum. It, ***a*** prepares the female reproductive organs for pregnancy in the luteal phase of the oestrus cycle; ***b*** maintains nourishment for the embryo by developing the placenta; ***c*** inhibits ovulation and menstruation in pregnant females; ***d*** stimulates growth of the mammary glands. ↑ FOLLICLE-STIMULATING HORMONE → OESTROUS CYCLE · PLACENTA[1]

JA059 progestogen (*n.*) A general term for any substance which has similar effects to progesterone. ↑ FOLLICLE-STIMULATING HORMONE

JA060 FSH (*abbr.*) Abbreviation for FOLLICLE-STIMULATING HORMONE (↑). ↓ LH · ESTROGEN · ESTRADIOL · LACTOGENIC COMPLEX · LTH · GONADOTROPIC

JA061 LH (*abbr.*) Abbreviation for LUTEINIZING HORMONE (↑).

JA062 estrogen (*n.*) Alternative term for OESTROGEN (↑).

JA063 estradiol (*n.*) Alternative term for OESTRADIOL (↑).

JA064 lactogenic complex (*n.*) A group of hormones, differing in different mammalian species, which is responsible for the initiation of milk production and secretion by the alveolar cells into the alveolar spaces of the mammary glands. ↑ FSH

JA065 LTH (*abbr.*) Abbreviation for PROLACTIN (↑).

JA066 gonadotropic (*adj.*) Describes substances affecting the gonads, *e.g.* androgens, oestrogens and progestogens are gonadotropic hormones. ↓ ANDROGENIC · OESTROGENIC · ESTROGENIC · LACTOGENIC ↑ GONADOTROPIN

JA067 androgenic (*adj.*) Describes a tissue which elaborates androgens. ↑ GONADOTROPIC

JA068 oestrogenic (*adj.*) Describes any substance that induces oestrus, *e.g.* an oestrogenic hormone is an oestrogen. ↑ GONADOTROPIC → OESTRUS

JA069 estrogenic (*adj.*) Alternative term for OESTROGENIC. ↑ GONADOTROPIC

JA070 lactogenic (*adj.*) Promoting the production and secretion of milk. ↑ GONADOTROPIC

JA071 phytohormones (*n.pl.*) The internal secretions of plant cells which function as hormones. They each have a broad function and do more than promote one activity; they also interact. Phytohormones appear to act in sequence; the cytokinins and gibberellins are more important in the early stages of development; the auxins are more important in the later stages; other phytohormones, such as abscisin, are important in senescence. ↓ AUXIN · ANTIAUXINS · CYTOKININS · FLORIGENS · KLINOSTAT ↑ DUCTLESS GLANDS · HORMONE

JA072 auxin (*n.*) A general name for plant hormones controlling growth. An auxin is produced by cells in the growing apices of stems and roots and is translocated to sites of action. The auxin stimulates cell elongation, thus promoting growth. Maximum stimulation in stems is effected by an auxin concentration of 1 p.p.m. (one part per million); in roots by 1/10 000 p.p.m.; in buds by 1/1000 p.p.m.; concentrations of an auxin greater than these inhibit growth after a gradual decline in stimulation to zero. Geotropism can be explained through auxin mechanisms; gravity causes a greater concentration of auxin to accumulate on the lower side of growing stems and roots; in stems such a concentration promotes faster growth, but in roots it inhibits growth. Phototropism has a similar explanation; auxins are produced in apices with greater concentrations away from the light; the concentration is such that stem growth is promoted on the shaded side (the stem bends towards the light), and root growth is inhibited on the shaded side (the root bends away from the light). Auxins also control apical dominance, stimulate cambium development, inhibit abscission, control fruit growth. In conjunction with other hormones, auxins may initiate, or promote, cell division. ↓ IAA · IAN · HETEROAUXIN · HETERAUXIN · GIBBERELLINS ↑ PHYTOHORMONES

JA073 IAA (*abbr.*) Abbreviation for **indole-3-acetic acid**; it is one of the commonest auxins in plants. ↑ AUXIN

JA074 IAN (*abbr.*) Abbreviation for **indole-3-acetonitrile**; it is an auxin. ↑ AUXIN

JA075 heteroauxin (*n.*) A growth-promoting phytohormone occurring in fungi. ↑ AUXIN

JA076 heterauxin (*n.*) Alternative term for HETEROAUXIN.

JA077 gibberellins (*n.pl.*) Growth phytohormones, complementary to the auxins; they cause noticeably large growth of the internodes of some plants. Other processes promoted by gibberellins include the breaking of dormancy of seeds and buds and the formation of fruits and flowers. They are also said to inhibit elongation of roots. ↑ AUXIN

JA078 antiauxins (*n.pl.*) Phytohormones which regulate plant growth by inhibiting growth stimulated by auxins. ↓ ABSCISIN · DORMIN ↑ PHYTOHORMONES · AUXIN

JA079 abscisin (*n.*) A hormone-like substance which promotes abscission in leaves, present in senescent leaves. It is thought to be an inhibitor of auxin in its action ↑ ANTIAUXINS → ABSCISSION

JA080 dormin (*n.*) A substance identical with abscisin; formed in leaves of some woody plants exposed to short photoperiods. It induces dormancy in buds of such plants. ↑ ANTIAUXINS → PHOTOPERIOD

JA081 cytokinins (*n.pl.*) A general term for phytohormones promoting cell division. They also promote root growth, leaf growth, and bud elongation, they initiate the formation of shoots and seed germination. The promotion of cell division requires the presence of auxin ↓ KINETIN · KININS · PHYTOKININS ↑ PHYTOHORMONES · AUXIN

JA082 kinetin (*n.*) The first cytokinin to be isolated; it also appears to be concerned with protein synthesis in plants. ↑ CYTOKININS

JA083 kinins (*n.pl.*) Alternative term for CYTOKININS (↑).

JA084 phytokinins (*n.pl.*) Alternative term for CYTOKININS (↑).

JA085 florigens (*n.pl.*) Flowering phytohormones. Florigens are produced by leaves under photoperiodic stimuli; the hormones are translocated by the phloem to apical meristems and induce apical buds to produce flowers, and not vegetative structures. ↓ TRAUMATINS · TRAUMATIC ACID ↑ PHYTOHORMONES → PHOTOPERIOD

JA086 traumatins (*n.pl.*) Phytohormones occurring in injured cells of plants. They promote the formation of a callus and the healing of wounds through the production of scar tissue from mature tissues by the division of uninjured cells. ↑ FLORIGENS

JA087 traumatic acid (*n.*) A common traumatin. ↑ FLORIGENS

JA088 klinostat (*n.*) A device which slowly rotates a plant on a horizontal axis to nullify the force of gravity. The device is used to demonstrate the effect of gravity on the distribution of auxin in a plant, and hence the effect of geotropism. It also is used to demonstrate that the influence of gravity on auxin persists for only about 40 minutes. ↑ PHYTOHORMONES · AUXIN → GEOTROPISM

Immunity

JB001 antigen (*n.*) Any foreign protein, or one of certain other large molecules, that when present in a host's tissues stimulates the production of a specific antibody by the host, a response leading to rejection of the antigen by the host. An antigen invades an individual, or is injected into an individual. —***antigenically*** (*adv.*) ***antigenic*** (*adj.*) ↓ ANTIBODY · TOXIN · TRANSFUSION · CLUMP[2] · TOXIC · INCOMPATIBLE · IMMUNITY → PATHOGEN · HYGIENE

JB002 antibody (*n.*) A protein produced in the blood of a living animal following the introduction of an antigen. An antibody is able specifically to combine with the antigen and thus to inactivate it. Some antibodies are formed by lymphocytes in the blood or tissues of animals. Plants do not form antibodies. ↓ AGGLUTININS · CLUMP[1] · NEUTRALIZATION[2] · OPSONIZATION · OPSONIN · PRECIPITATION · AGGLUTINATION · ALLERGY ↑ ANTIGEN → LYMPHOCYTE

JB003 agglutinins (*n.*) Antibodies that cause bacterial cells to clump together. ↑ ANTIBODY

JB004 clump[1] (*n.*) **1** A group of cells sticking together to form a solid mass of cells; no biological association exists between the cells; their surfaces adhere due to chemical action, *e.g.* a clump of red blood cells. **2** A small group of trees or herbs growing close together in the ground. —CLUMP (*v.*) ***clumped*** (*adj.*) ***clumping*** (*n.*) ↑ ANTIBODY

JB005 neutralization[2] (*n.*) An antibody-antigen reaction in which a biologically active antigen is made inactive; the term is strictly applied to the neutralization of toxins and of viral infectivity. Neutralization expresses the ability of an antibody to protect an individual against the harmful effects of an antigen. *In vivo* this reaction takes place at the time of infection. ↑ ANTIBODY

JB006 opsonization (*n.*) The coating of the capsule of a bacterium with antibody (the antibody is a protein called opsonin). This makes it easier for phagocytes to ingest the bacterium. This is the most important role of antibodies in immunity. —OPSONIC (*adj.*) ↑ ANTIBODY

JB007 opsonin (*n.*) A protein produced in the blood; it makes bacteria more readily ingestible by phagocytes. ↑ ANTIBODY

JB008 precipitation (*n.*) The process in which antibodies acting on soluble antigens form a precipitate (a clump of molecules). An important reaction *in vitro* but unimportant *in vivo*. ↑ ANTIBODY

JB009 agglutination (*n.*) The action of agglutinating. ↑ ANTIBODY

JB010 allergy (*n.*) In some cases the combination of antibody and antigen can cause severe damage to the host. The individual is hypersensitive or allergic to the antigen. Some individuals are allergic to certain foodstuffs, animal hairs, or pollen. In allergy of infection, an individual becomes allergic by first being sensitized by exposure to an antigen. After antibody formation has taken place, any subsequent exposure to the antigen causes allergy. Rheumatic fever is an allergy of this type, arising from a series of streptococcal infections. —***allergic*** (*adj.*) ↑ ANTIBODY

JB011 toxin (*n.*) A substance, which is usually a protein, but can also be another type of substance, with a high relative molecular mass; it is biosynthesized by an organism, especially a pathogen. A toxin is poisonous or harmful to an organism, other than the organism producing it □ *excreting a virulent toxin; secreting a mild toxin* —TOXIGENICITY (*n.*) TOXIC (*adj.*) ↓ TOXIGENICITY · ANTITOXIN · ENDOTOXIN · EXOTOXIN · POISON · TOXICOLOGY · TOXICITY · TOXOID ↑ ANTIGEN → BIOSYNTHESIS

JB012 toxigenicity (*n.*) The disposition to produce toxins shown by pathogenic species of parasites. Syphilis spirochaetes have a

low toxigenicity (their virulence is due to high invasiveness, *i.e.* they can penetrate to all parts of the body). ↑ TOXIN

JB013 antitoxin (*n.*) An antibody that specifically combines with a toxin and neutralizes it. Antitoxins are contained in antiserum. ↑ TOXIN

JB014 endotoxin (*n.*) A toxin formed within the protoplasm of a bacterium; it is released when the bacterial cell is ruptured on lysis or death. Endotoxins are relatively heat stable and weakly toxic. Examples of endotoxins are the toxins causing typhoid fever and cholera. ↓ EXOTOXIN (An) ↑ TOXIN

JB015 exotoxin (*n.*) A soluble toxin excreted by a bacterium or a protozoan. Exotoxins are heat sensitive proteins, and highly toxic. Examples of exotoxins are the toxins causing tetanus and diphtheria. ↑ ENDOTOXIN (An) · TOXIN

JB016 poison (*n.*) Any chemical substance which may cause death or serious damage to health if introduced into an individual (plant or animal) is a poison, *e.g.* compounds of arsenic; strychnine; nicotine. By contrast, a toxin is a poisonous substance produced by an animal or plant. —***poisonous*** (*adj.*) ***poison*** (*v.*) ↑ TOXIN (H) → VENOM

JB017 toxicology (*n.*) The study of toxins. ↑ TOXIN

JB018 toxicity (*n.*) The measure of the toxic properties of a substance, *e.g.* a protein of high toxicity is a substance which is highly toxic □ *an exotoxin is a protein of high toxicity; most endotoxins have a low toxicity* ↑ TOXIN

JB019 toxoid (*n.*)A toxin deprived of its toxic nature but still able to induce the formation of antitoxins. ↑ TOXIN

JB020 transfusion (*n.*) The process of putting blood from one person (a **donor**) into the body of another person (the **recipient**). Other liquids besides blood, such as plasma, salt solution, etc., can be used in a transfusion. —***transfuse*** (*v.*) ↓ COMPATIBILITY · INCOMPATIBILITY ↑ ANTIGEN

JB021 donor[3] (*n.*) See TRANSFUSION.

JB022 recipient[2] (*n.*) See TRANSFUSION.

JB023 compatibility (*n.*) **1** The property of each of two or more substances that can exist together without change; each substance is compatible with the other. **2** The property of a substance (usually a protein) that can be put in a human, or other animal body, without being rejected, *e.g.* compatibility between the blood of a donor and that of a recipient (the donor's blood is not rejected by the recipient, *i.e.* it is not coagulated by antibodies). —***compatible*** (*adj.*) ↓ INCOMPATIBILITY (I) ↑ TRANSFUSION

JB024 incompatibility (*n.*) The disposition of a substance (usually a protein) to be rejected by the body of an individual, *e.g.* incompatibility between the blood of a donor and the blood of a recipient causing the donor's blood to be coagulated and rejected by the recipient. ↑ COMPATIBILITY (I) · TRANSFUSION

JB025 clump[2] (*v.t.,i.*) **1** (*v.t.*) To cause cells to stick together in a group by the action of a suitable chemical substance. **2** (*v.i.*) (Of cells) to stick together in this way □ *to clump red blood cells together* ↓ AGGLUTINATE ↑ ANTIGEN

JB026 agglutinate (*v.i.*) To join together by sticking, as with glue; to form a clump. A term applied to cells, such as blood cells, when they clump together and are held by antibodies chemically combined with surface antigens of the cell. Agglutination occurs *in vitro*; it is doubtful whether it occurs *in vivo*. —AGGLUTINATION (*n.*) AGGLUTININS (*n.*) ***agglutinated*** (*adj.*) ↑ CLUMP[2]

JB027 toxic (*adj.*) Describes a substance which is poisonous or harmful to living organisms, or which has the disposition to be poisonous or harmful under suitable conditions. —TOXICOLOGY, TOXICITY (*n.*) ↓ TOXIGENIC · OPSONIC ↑ ANTIGEN

JB028 toxigenic (*adj.*) Describes an organism capable of producing a toxin. To contrast **toxic** and **toxigenic**; highly toxigenic bacteria secrete highly toxic exotoxins. ↑ TOXIC

JB029 opsonic (*adj.*) Describes an effect connected with opsonization, *e.g.* opsonic adherence between phagocytes and bacteria. ↑ TOXIC

JB030 incompatible (*adj.*) **1** Describes substances that cannot exist together, *i.e.* a change occurs on mixing them. **2** Describes a substance (usually a protein) exhibiting incompatibility □ *blood of group A is incompatible with blood of group B* —INCOMPATIBILITY (*n.*) ↑ ANTIGEN

JB031 compatible (*adj.*) **1** Describes substances that can exist together or can be mixed without a chemical change taking place. **2** Describes a substance that the body will accept, *e.g.* blood of a compatible blood group is used in a transfusion. ↑ INCOMPATIBLE[1]

JB032 immunity (*n.*) The ability of an animal to resist specifically infection from pathogens because of the presence of antibodies. Each pathogen requires specific antibodies. An immune animal has a lasting ability to produce rapidly large amounts of antibody in response to fresh infections. The duration of this ability varies with the disease or specific pathogen. Immunity may be natural, acquired, or artificial, active or passive. The subject matter of immunity is usually restricted to the reactions of vertebrates only □ *to possess an immunity to diphtheria; to give immunity to the patient; immunity is conferred on a person after recovery from a mild form of the disease* —IMMUNE (*adj.*) ***immunize*** (*v.*) IMMUNIZATION, ***immunology*** (*n.*) ↓ NATURAL IMMUNITY · ARTIFICIAL IMMUNITY · IMMUNIZATION · INOCULATE · IMMUNE ↑ ANTIGEN

JB033 natural immunity (*n.*) An immunity inherited from parents, usually genetically controlled. Antibodies are present in the

blood of the new-born child. ↓ ACQUIRED IMMUNITY · IMMUNITY IN PLANTS · PASSIVE NATURAL IMMUNITY · ACTIVE NATURAL IMMUNITY ↑ IMMUNITY

JB034 acquired immunity (*n.*) Immunity conferred on an individual after recovery from a mild form of the disease; it is usually more effective than artificial immunity. Also called ***natural acquired immunity.*** ↑ NATURAL IMMUNITY

JB035 immunity in plants (*n.*) Plants do not produce antibodies; they have three defences against the attack of fungi and viruses, ***a*** waxy cuticle which prevents entry of pathogens; ***b*** protoplasts which are unfavourable substrates for pathogens; ***c*** a non-sterile type of immunity depending either on the presence of avirulent strains of viruses inhibiting the development of virulent strains, or the presence of an active virus after recovery from an acute disease inhibiting further development of the same virus, the immunity lasting for the period the plants are infected. ↑ NATURAL IMMUNITY

JB036 passive natural immunity (*n.*) An alternative term for NATURAL IMMUNITY(↑).

JB037 active natural immunity (*n.*) An alternative term for ACQUIRED IMMUNITY (↑).

JB038 artificial immunity (*n.*) Injection of antigens of a specific disease into an individual to stimulate the production of antibodies for the disease, or injection of antibodies for the disease, confers artificial immunity on the individual against the disease □ *vaccination confers artificial immunity on an individual; vaccination gives an artificial immunity to an individual* ↓ ACTIVE ARTIFICIAL IMMUNITY · PASSIVE ARTIFICIAL IMMUNITY · LYSOZYME · GLOBULINS · NON-SPECIFIC RESISTANCE · INTERFERON · COMPLEMENT · IMMUNOGLOBULIN · NON-SPECIFIC IMMUNITY ↑ IMMUNITY

JB039 active artificial immunity (*n.*) Immunity where the patient is injected with a vaccine; the body responds by production of antibodies; subsequent attack by agents of the disease provokes a rapid response in antibody production. ↑ ARTIFICIAL IMMUNITY

JB040 passive artificial immunity (*n.*) Immunity where the patient is injected with antiserum containing antibodies and antitoxins. This type of injection is used when the patient is already suffering from the disease, and it strengthens his resistance. ↑ ARTIFICIAL IMMUNITY

JB041 lysozyme (*n.*) An enzyme that attacks the cell wall of bacteria, and destroys, or weakens it, causing lysis of the bacterial cell. Lysozymes occur in tears, saliva, and mucus, and are also secreted by the skin; they form part of the non-specific resistance to disease. ↑ ARTIFICIAL IMMUNITY → ENZYME

JB042 globulins (*n.pl.*) Proteins that are soluble in salt solution, but not in water, and are coagulated by heat. Antibodies are globulins termed immunoglobulins; globulins occur in most cells of plants and animals; globulins form the protein part of haemoglobin, and of fibrinogen. ↑ ARTIFICIAL IMMUNITY → HAEMOGLOBIN · FIBRINOGEN

JB043 non-specific resistance (*n.*) The resistance of an organism to the invasion of pathogens not involving the action of antibodies. Defences are, ***a*** an impervious skin; ***b*** the antiseptic action of mucus or mucous membranes; ***c*** an antiseptic stomach (due to acid); ***d*** phagocytic cells in lymph, bloodstream, and tissues; ***e*** inflammation in tissues forming a barrier of clotted fibrin and phagocytes; ***f*** the production of interferon or lysozyme. Contrast **specific resistance**, which arises from the presence of antibodies. ↑ ARTIFICIAL IMMUNITY → MUCUS · FIBRIN · PHAGOCYTE

JB044 interferon (*n.*) A protein biosynthesized in an animal cell as a result of infection by a virus; it inhibits non-specifically the replication of viruses. A virus can also cause the production of interferon to inhibit the replication of other types of virus. ↑ ARTIFICIAL IMMUNITY → VIRUS

JB045 complement (*n.*) A substance present in the serum of normal animals; it is destroyed by heat. Complement destroys by lysis cells which have been coated with antibody; both complement and antibody are necessary for this action and also for bactericidal action. Complement is a group of several different proteins. ↑ ARTIFICIAL IMMUNITY → LYSIS

JB046 immunoglobulin (*n.*) A globulin which is an antibody. ↑ ARTIFICIAL IMMUNITY

JB047 non-specific immunity (*n.*) An alternative term for NON-SPECIFIC RESISTANCE (↑). ↑ ARTIFICIAL IMMUNITY

JB048 immunization (*n.*) The giving of artificial immunity. ↓ VACCINE · ANTISERUM · SERUM[2] · VACCINATION · INOCULATION · INOCULUM ↑ IMMUNITY

JB049 vaccine (*n.*) A sterile liquid medium containing an avirulent strain of a specific pathogen. The pathogen is made avirulent, ***a*** by cultivating it under conditions which cause its attenuation; ***b*** by killing a virulent strain of pathogens. Examples of vaccines are the attenuated virus of rabies, the attenuated bacillus of tuberculosis (B.C.G.), the killed bacillus of cholera. —***vaccinated*** (*adj.*) VACCINATION (*n.*) ***vaccinate*** (*v.*) ↑ IMMUNIZATION → AVIRULENT

JB050 antiserum (*n.,pl.* **antisera**) A suitable animal is inoculated with a specific pathogen or other antigen. When a sufficiently high concentration of antibodies is present in the animal's blood, blood is withdrawn and serum prepared. This is called antiserum because it contains antibodies to the antigens. Antiserum injected into a patient gives immediate protection against the antigens. It does not stimulate the production of antibodies in the patient. Examples of antisera are diphtheria antiserum and tetanus antiserum. ↑ IMMUNIZATION → TOXOID

JB051 serum[2] (*n.,pl.* **sera**) A common, less

exact, alternative term for ANTISERUM. ↑ IMMUNIZATION

JB052 vaccination (*n.*) **1** (Bio.) The act of inoculating an individual with a vaccine. **2** (G.S.) The application of smallpox vaccine to a scratch on the skin of an individual. ↑ IMMUNIZATION

JB053 inoculation (*n.*) **1** The act of inoculating. **2** The vaccine or antiserum used in inoculating an individual. ↓ INOCULATE ↑ IMMUNIZATION

JB054 inoculum (*n.*) The minute quantity of micro-organisms used to seed a culture medium. ↑ IMMUNIZATION

JB055 inoculate (*v.t.,i.*) **1** To introduce or to put micro-organisms into a culture medium or into a larger organism. **2** To inject a vaccine or an antiserum into an individual □ *to inoculate against cholera; to inoculate with a known strain of bacteria; to inoculate by means of a hypodermic syringe* —INOCULATION, INOCULUM (*n.*) ***inoculated*** (*adj.*) ↑ IMMUNITY

JB056 immune (*adj.*) Describes an individual plant or animal resistant to infection from a specific pathogen, *i.e.* an individual with immunity. ↓ ATTENUATED · INTRAVENOUS ↑ IMMUNITY

JB057 attenuated (*adj.*) (Of bacteria and viruses) made less virulent; this state is often achieved by culturing the pathogens to develop thinner capsules or coats. —***attenuation*** (*n.*) ↑ IMMUNE → VIRULENT

JB058 intravenous (*adj.*) Describes an injection put into a vein; an alternative method of injection is subdermal (or subcutaneous), *i.e.* under the skin. ↑ IMMUNE

Pathogenicity

JC001 pathogen (*n.*) A parasite or a substance which causes disease. A specific pathogen is the causative agent of a specific disease. —PATHOGENIC (*adj.*) PATHOGENICITY (*n.*) ↓ DISEASE · VECTOR[1] · PATHOGENICITY · EXPOSURE · PATHOLOGY · EXPOSE · ACUTE[2] · INFECTIOUS · ENDEMIC · CAUSATIVE AGENT · INJURY · SYMPTOM · CLINIC · DEGENERATIVE DISEASE · DEFICIENCY DISEASE → ANTIGEN

JC002 disease (*n.*) A disordered state of a tissue, organ, system, or organism, during which the functions of these are not carried out normally. An **infectious disease** is due to invasion of a host by a pathogen. An **organic disease** is due to degeneration of tissues. A disease is diagnosed from signs and symptoms. A disease is identified after diagnosis. Infectious diseases can be transmitted from one person to another □ *benign disease; to suffer from a malignant disease; reservoirs of disease for yellow fever; typhoid fever is an acute disease; mumps is a mild disease; cholera is a fatal disease* —***diseased*** (*adj.*) ↓ ILLNESS (Sn) · SICKNESS · DISORDER[2] · NAUSEA · INCUBATION[2] · CLINICAL DISEASE · AILMENT · RELAPSE · CURE[1] · HEALTH · ILL-HEALTH ↑ PATHOGEN

JC003 illness (*n.*) A disordered state of tissues, caused by the presence of pathogens or caused by the degeneration of tissues. A disease causes illness. Illness results from a disease (not diagnosed); it is not transmitted. ↑ DISEASE

JC004 sickness (*n.*) A reaction of the body to pathogens or to external circumstances. When the reaction is caused by a pathogen, sickness and illness are alternative terms. The reaction of the body, ***a*** to reduced air pressure causes mountain sickness; ***b*** to a ship's motion causes sea-sickness. Some forms of nausea are called sickness, *e.g.* morning sickness occurring in pregnant women. —***sick*** (*adj.*) ↑ DISEASE (Sn)

JC005 disorder[2] (*n.*) A mild form of malfunctioning, not causing disease, but leading to general ill-health that is not of a serious nature, *e.g.* a stomach disorder, when digestion is incomplete or defective. ↑ DISEASE

JC006 nausea (*n.*) A tendency to vomit, usually a symptom of stomach disorder. —***nauseate*** (*v.*) ↑ DISEASE → VOMIT[2]

JC007 incubation[2] (*n.*) The period of time between an initial infection and the appearance of signs or symptoms caused by a pathogen. ↑ DISEASE

JC008 clinicial disease (*n.*) The presence of the signs and symptoms of a specific disease that allow the disease to be diagnosed accurately, *i.e.* accurate observation identifies a specific disease, and the patient suffers from the named clinical disease. ↑ DISEASE

JC009 ailment (*n.*) A general term for all types of pathological or other abnormal conditions, particularly before diagnosis and particularly when an individual is aware of his condition, *e.g.* malaise is an ailment; diarrhoea, without apparent cause, is an ailment. ↑ DISEASE

JC010 relapse (*n.*) A return of a disease after an individual has started to recover from a previous attack —RELAPSE (*v.*) ***relapsing*** (*adj.*) ↑ DISEASE

JC011 cure[1] (*n.*) The process of successfully treating a person, usually by the use of drugs or antibiotics, to eliminate illness and restore full health □ *a cure of tuberculosis is effected by antibiotics; a cure is still sought for cancer; a cure is brought about by suitable*

living conditions —CURE (*v.*) ***curative*** (*adj.*) ↑ DISEASE

JC012 health (*n.*) A state in which all the correct functions of an organism are carried out. In the case of human beings, this is a state of physical, social, and mental well-being □ *to be in good health; to be in poor health; to have bad health; to suffer ill health* —***healthy*** (*adj.*) ↑ DISEASE (I)

JC013 ill health (*n.*) A state of an animal in which the functions of the organism are not performed correctly. The cause of malfunction may be physical or mental. The state is not sufficiently serious, nor are the symptoms sufficiently distinguishable, to say that the animal is suffering from sickness or disease. ↑ DISEASE · HEALTH (An)

JC014 vector[1] (*n.*) An animal which transmits causative agents of disease; the term is also applied to physical means of transmission, *e.g.* air, water, food and contact are physical vectors, *e.g.* ***a*** a female *Anopheles* mosquito is the vector for malaria (the insect transmits malarial parasites from a patient to a healthy person); ***b*** some species of snail are the vector for bilharziasis (bilharzia flukes have part of their life cycle in the snail, which is then part of the transmission cycle); ***c*** contaminated water is the vector for cholera (the water transmits the cholera bacteria). ↓ TRANSMISSION OF PATHOGENS · PORTAL OF ENTRY · INFECTION · CONTAGION · RESERVOIR OF INFECTION · CARRIER[1] · GERM ↑ PATHOGEN

JC015 transmission of pathogens (*n.*) Transmission is the process by which a pathogen goes from a source of infection to a host. There are five modes of transmission, ***a*** ingestion of contaminated food or drink; ***b*** inhalation of contaminated airborne droplets; ***c*** direct contact; ***d*** injection into tissue by animal bite; ***e*** introduction of foreign material into a wound. —***transmissible*** (*adj.*) TRANSMISSIBILITY (*n.*) ↑ VECTOR[1]

JC016 portal of entry (*n.*) The place through which a pathogen gains entry to the body of an animal. ↑ VECTOR[1]

JC017 infection (*n.*) **1** The action, or process, of pathogens gaining entry to the body of an animal. **2** A disease caused by living micro-organisms, particularly a disease transmitted by either a mechanical or an animal vector. —***infect*** (*v.*) INFECTIOUS (*adj.*) ↑ VECTOR[1]

JC018 contagion (*n.*) The transmission of disease by personal contact. —***contagious*** (*adj.*) ↑ VECTOR[1]

JC019 reservoir of infection (*n.*) In the case of certain diseases, both animals and man suffer from the same disease; the disease can be controlled in the human population, but not in the animal population; the animals act as a source of infection after the disease has been controlled, *i.e.* they are a reservoir of infection. ↑ VECTOR[1]

JC020 carrier[1] (*n.*) A person infected with a disease, but showing no signs or symptoms of the clinical disease, although he is capable of transmitting the disease, *e.g.* a typhoid carrier appears to be in normal health, but he can infect food and so transmit the disease. ↑ VECTOR[1]

JC021 germ (*n.*) (G.S.) A vague term used instead of pathogen. It should not be used in scientific descriptions. —GERMICIDAL (*adj.*) ↑ VECTOR[1]

JC022 pathogenicity (*n.*) The disposition of being pathogenic. It is an attribute of a species, genus, or family, or of organisms which are parasites causing harm to the host. Pathogenicity depends on transmissibility, infectivity and virulence. —PATHOGEN (*n.*) PATHOGENIC (*adj.*) ↓ INVASIVENESS · VIRULENCE · TRANSMISSIBILITY · INFECTIVITY ↑ PATHOGEN

JC023 invasiveness (*n.*) The ability of a pathogen to penetrate its host's tissues. A diphtheria bacterium has a low invasiveness, as it is located only in the throat (virulence is due to a high toxigenicity in this case). ↑ PATHOGENICITY

JC024 virulence (*n.*) The relative pathogenicity of a parasite. A highly virulent strain of a pathogenic species causes considerable harm. An avirulent strain causes little harm. Virulence depends on invasiveness and toxigenicity. —***virulent*** (*adj.*) ↑ PATHOGENICITY → TOXIGENICITY

JC025 transmissibility (*n.*) The disposition of being transmissible; it is determined by the ease with which a pathogen is transmitted by a vector. ↑ PATHOGENICITY

JC026 infectivity (*n.*) The disposition of being infective. It is the ability of a parasite to establish itself in, or on, its host. It depends upon the parasite's adaptation to a host's nutritional environment and on its resistance to a host's defence mechanisms. ↑ PATHOGENICITY

JC027 exposure (*n.*) (Of an organism) the state of being exposed to usually unfavourable, difficult, or adverse conditions, *e.g.* exposures to a disease (*i.e.* with no protection from prophylactic measures and with conditions unfavourable for healthy living). ↓ EPIDEMIC[1] · ORGANIC DISEASE · SEPTICAEMIA ↑ PATHOGEN

JC028 epidemic[1] (*n.*) A sudden large increase in the prevalence of a disease, *e.g.* ***a*** an epidemic of cholera in a port; ***b*** a smallpox epidemic in a country. —EPIDEMIC[2] (*adj.*) ↑ EXPOSURE

JC029 organic disease (*n.*) A disease which affects the structure of an organ, *e.g.* an organic disease of the heart affects the arteries of the heart. Such diseases are not caused by pathogens, but by a malfunctioning of the organ concerned. ↑ EXPOSURE

JC030 septicaemia (*n.*) A condition in which pathogenic bacteria circulate and multiply in the blood; it is marked by a high fever, a high pulse rate, and in some cases, a rash. The bacteria gain entry from a septic wound or an infected tissue. —SEPTICAEMIC (*adj.*) ↑ EXPOSURE

JC031 pathology (*n.*) A branch of medical science concerned with diseases, their causative agents, and their effect on the

body. —PATHOLOGICAL (*adj.*) ***pathologist*** (*n.*) ↑ PATHOGEN

JC032 expose (*v.t.*) To put an organism in the way of light (especially sunlight), wind, rain, or adverse conditions generally; to leave without protection from conditions or circumstances, *e.g.* to expose a person to disease. The focus is on the adverse effect of exposing. —EXPOSURE (*n.*) ***exposed*** (*adj.*) ↓ AFFLICT · COMBAT · ALLEVIATE · CURE[2] · TREAT[2] · INFLICT ↑ PATHOGEN

JC033 afflict (*v.t.*) To cause pain to, or ill-health or pathological conditions in, *e.g.* ***a*** some species of *Entamoeba* afflict their host with amoebic dysentery; ***b*** a person afflicted with cholera (the disease causes pain and pathological conditions). —***affliction*** (*n.*) ***afflicted*** (*adj.*) ↑ EXPOSE

JC034 combat (*v.t.*) To oppose factors in adverse conditions or the attack of causative agents of disease, *e.g.* ***a*** the body combats the viruses causing influenza; ***b*** some mammals grow thick fur to combat cold weather. ↑ EXPOSE

JC035 alleviate (*v.t.*) To lessen pain or disease, *e.g.* ***a*** a drug to alleviate a headache (it makes the pain less, but does not get rid of it entirely); ***b*** injections of salt water alleviate the symptoms of cholera (the disease is not cured, but the dehydration, caused by the disease, is made less). —***alleviation*** (*n.*) ***alleviated*** (*adj.*) ↑ EXPOSE

JC036 cure[2] (*v.t.*) To make a person well when he is suffering from a disease; to restore a person to health from illness. —CURE (*n.*) ***cured*** (*adj.*) ↑ EXPOSE

JC037 treat[2] (*v.t.*) To use drugs, antiseptics, or other clinical methods, to attempt to cure, or to alleviate an ailment or a disease, or a person suffering from these, *e.g.* ***a*** to treat a patient for plague by using antibiotics; ***b*** to treat a wound by applying antiseptics, and covering it; ***c*** to use any therapeutic substance for a pathological condition. If the treatment is successful, the patient is cured; the treatment of a disease does not imply that the disease will be cured. —***treatment*** (*n.*) ↑ EXPOSE

JC038 inflict (*v.t.*) To cause to suffer an injury, pain, hardship or a pathological condition, *e.g.* bacteria inflict many diseases on human beings. The focus is on the agent. Contrast **afflict**: human beings are afflicted with many diseases by bacteria (the focus is on the recipient) □ *to* inflict *a disease* on *an organism* —***infliction*** (*n.*) ***inflicted*** (*adj.*) ↑ EXPOSE

JC039 acute[2] (*adj.*) (Of diseases) becoming rapidly more severe, but not lasting for a long time. ↓ CHRONIC (Ag) · MALIGNANT · BENIGN · AVIRULENT · HEALTHY · VIRULENT ↑ PATHOGEN

JC040 chronic (*adj.*) (Of diseases) continuing for a long time, usually unchanging, or only changing slowly in degree of severity. ↑ ACUTE[2] (Ag)

JC041 malignant (*adj.*) **1** (Of diseases) having the disposition to become worse until they cause death. **2** (Of abnormal growths in tissues) having the tendency to grow and to spread to other parts of the body, even when the original growth is removed by surgery, and eventually to cause death. —***malignancy*** (*n.*) ↓ BENIGN (An) ↑ ACUTE[2]

JC042 benign (*adj.*) **1** (Of diseases) having the disposition to improve and not to cause death. **2** (Of abnormal growths in tissue) having the tendency to grow, but not to spread to other parts of the body, and not to cause death. ↑ ACUTE[2]

JC043 avirulent (*adj.*) Describes a pathogen with a very low virulence, causing little harm to its host. ↓ VIRULENT (Ag) ↑ ACUTE[2]

JC044 healthy (*adj.*) **1** (Of persons) in full health. **2** (Of wounds) in the process of healing and having no infection or suppuration. ↑ ACUTE[2]

JC045 virulent (*adj.*) Describes a pathogen with a high virulence, causing considerable harm to its hos ACUTE[2] · AVIRULENT (Ag)

JC046 infectious (*adj.*) Describes a disease that can be transmitted by a vector, or the stage of a disease during which it can be transmitted, *e.g.* the infectious period of smallpox starts before the signs and symptoms appear. The term describes a disposition, as the disease may or may not be transmitted. ↓ CONTAGIOUS · INFECTIVE · INFECTED · PATHOLOGICAL · PATHOGENIC · SEPTICAEMIC ↑ PATHOGEN

JC047 contagious (*adj.*) Describes an infectious disease that can be transmitted by personal contact, *e.g.* ringworm and other skin diseases. ↑ INFECTIOUS

JC048 infective (*adj.*) Describes a person, or an animal vector, that is capable of infecting an individual, *e.g.* 9 days after biting a malarial patient, a female mosquito becomes infective, *i.e.* it can transmit the disease □ *the female mosquito is infective to man* ↑ INFECTIOUS

JC049 infected (*adj.*) Describes the state of a person, or animal, or plant, or any object into which pathogens have gained entry, or on which there are pathogens, *e.g.* ***a*** many individuals are infected with tuberculosis bacteria, but do not exhibit symptoms of the disease (the bacteria have gained entry); ***b*** plants infected with virus diseases may die. ↑ INFECTIOUS

JC050 pathological (*adj.*) Describes the state or condition of a body or part of a body which is not functioning normally; the abnormal functioning is caused by pathogens; the term describes a state. **2** Of or to do with pathology, *e.g.* a pathological laboratory. ↑ INFECTIOUS

JC051 pathogenic (*adj.*) Describes a micro-organism causing disease in relation to a given host, *e.g.* plasmodia are pathogenic for human beings and monkeys, but are not pathogenic for reptiles and other animals. To contrast **pathogenic** and **pathological**: a person infected with pneumococci suffers from pneumonia; the pneumococci are pathogenic for the person, and the person's

condition is pathological. ↑ INFECTIOUS · INFECTIVE (Sn)

JC052 septicaemic (*adj.*) Describes a disease in which the pathogens invade the blood, *e.g.* septicaemic plague in which the plague bacteria invade the blood, as well as produce the general signs and symptoms of plague. ↑ INFECTIOUS

JC053 endemic (*adj.*) **1** (Of diseases) occurring continuously in certain regions or among certain groups of people, *e.g.* ***a*** malaria is endemic in some parts of Africa (there are always people suffering from malaria in those areas, but the number is never excessive); ***b*** bilharziasis is endemic amongst people who work in snail-infested waters (a definite percentage, which may be high, of such people suffer from bilharziasis). **2** (Of pests or pathogenic parasites) limited to a certain region or occurring continuously in a given region, *e.g.* mosquitoes are endemic in tropical regions (they are always present). ↓ EPIDEMIC[2] · PANDEMIC · SPORADIC ↑ PATHOGEN

JC054 epidemic[2] (*adj.*) Describes or relates to a disease with a sudden large increase in occurrence, *e.g.* epidemic influenza occurred in 1918 in Europe □ *a disease of epidemic proportions* ↑ ENDEMIC

JC055 pandemic (*adj.*) Describes an epidemic disease spread over a large area, usually considered to be a continent or the whole world, *e.g.* certain types of influenza, such as Asian influenza, have been pandemic (it spread over most of Asia and Europe in a period of 2–3 years). ↑ ENDEMIC

JC056 sporadic (*adj.*) **1** (Of diseases) occurring irregularly from time to time or in widely dispersed localities, being quiescent between outbursts. **2** (Of plants) limited to certain widely separated localities. ↑ ENDEMIC

JC057 causative agent (*n.*) A pathogen causing a specific disease; it may be a virus, a bacterium, a spirochaete, a protozoan, a fungus, or a metazoan, *e.g.* ***a*** *Plasmodium*, a protozoan causing malaria; ***b*** the variola virus which causes smallpox; ***c*** *Wuchereria bancroftii*, a metazoan, a filarial worm which causes elephantiasis. ↓ BACTERIA · VIRUS · ENDOSPORE · BLIGHT · BACTERICIDAL · BACILLIFORM ↑ PATHOGEN

JC058 bacteria (*n.pl., sing.* **bacterium**) A collection of unicellular micro-organisms with a primitive cellular structure, in which the hereditary material is not confined within a nuclear membrane. All possess a rigid cell wall giving them a specific shape. The cell wall can be surrounded by a capsule or a slime layer. Bacteria are not classified as plants or animals. ***—bacterial,*** BACTERIOSTATIC, ***bactericidal*** (*adj.*) ***bacteriology, bacteriologist*** (*n.*) ↓ COCCUS · DIPLOCOCCUS · STREPTOCOCCUS · STAPHYLOCOCCUS · BACILLUS · VIBRIO · SPIRILLUM · SPIROCHAETE ↑ CAUSATIVE AGENT → BACTERIUM

JC059 coccus (*n.,pl* **cocci**) A bacterium which is spherical in shape; such bacteria are usually non-motile. ***—coccal*** (*adj.*) ↑ BACTERIA

JC060 diplococcus (*n.,pl.* **diplococci**) A chain formed from two cocci. ↑ BACTERIA

JC061 streptococcus (*n.,pl.* **streptococci**) One of a group of bacteria which form long chains of cocci. These bacteria cause diseases such as pneumonia, scarlet fever and puerperal fever. ***—streptococcal*** (*adj.*) ↑ BACTERIA

JC062 staphylococcus (*n.,pl.* **staphylococci**) One of a group of bacteria which form clusters of cocci, causing boils and abscesses. ***—staphylococcal*** (*adj.*) ↑ BACTERIA

JC063 bacillus (*n.,pl.* **bacilli**) **1** A genus of rod-shaped bacteria which form endospores under adverse conditions; the cell splits transversely in binary fission, *e.g.* the bacillus causing anthrax. ↑ BACTERIA

JC064 vibrio (*n.*) A curved rod-shaped bacterium with usually one flagellum; a member of the genus *Vibrio*. The bacteria are very motile, *e.g.* the vibrio causing cholera. ↑ BACTERIA

JC065 spirillum (*n.*) **1** A spiral-shaped bacterium, usually with tufts of flagella at both ends, *e.g.* the bacteria normally present in the mouth. Reproduction is by transverse binary fission. **2** A member of the genus *Spirillum*. ↑ BACTERIA

JC066 spirochaete (*n.*) An elongated micro-organism, twisted in the form of a spiral, with or without flagella. Spirochaetes are usually classified with bacteria, but unlike true bacteria they possess flexible cell walls and reproduce by longitudinal binary fission. Contraction of fibrils in the cell walls brings about a corkscrew type of locomotion. Spirochaetes can be either free-living or parasitic, *e.g.* the spirochaetes of leptospirosis and of yaws. ↑ BACTERIA

JC067 virus (*n.*) A sub-microscopic infectious agent, many of which are causative agents of disease in plants and animals. Viruses consist usually of a centre part containing nucleic acid, surrounded by a coat of protein, or of protein and lipid. The nucleic acid is: DNA or RNA in viruses attacking animals; RNA in viruses attacking plants; usually DNA in bacteriophages. Viruses replicate within their host's cells, forming new virions which invade further cells of the host. Viruses can only replicate intracellularly, so they cannot be cultured in a non-living medium. The nucleic acid of the virus takes control of the nucleus in the host cell; during this process the cell may be destroyed or may produce toxins which cause the clinical disease associated with the virus. Examples of viruses are the virus causing influenza and the virus causing yellow fever. The vectors for viruses attacking animals are either droplet infection, personal contact, or biting insects. VIRION (*n.*) VIRAL (*adj.*) ↓ VIRION · BACTERIOPHAGE · PHAGE · INDUCER · RICKETTSIA ↑ CAUSATIVE AGENT → DNA

JC068 virion (*n.*) A mature, single virus; it attacks one cell of its host. ↑ VIRUS

JC069 bacteriophage (*n.*) A virus that is a parasite on bacteria. It consists of a polyhedral head covered by a coat of protein which extends to form a short tail. The head is 50–100 nm long, and the tail about the same length. The head contains DNA, or, very occasionally, RNA instead of DNA. The tail attaches itself to a bacterial cell wall, and through enzyme action perforates the wall; the DNA enters the bacterial cell leaving the empty coat outside the cell. The DNA takes control of the bacterial cell, replicates its own DNA, and more virions are produced. Lysis of the bacterial cell occurs, releasing the newly formed bacteriophages to attack other bacterial cells. ↑ VIRUS

JC070 phage (*n.*) Alternative term for BACTERIOPHAGE.

JC071 inducer (*n.*) In viruses with DNA, which attack animals, the protein coat acts as an inducer; it enters the host cell's nucleus, produces messenger RNA, which goes to the cytoplasm, forms a protein in a ribosome, and the protein releases the DNA from the virion in the cytoplasm. The DNA enters the host cell nucleus and replication of the virus starts. ↑ VIRUS

JC072 rickettsia (*n.,pl.* **rickettsiae**) An obligate parasite of fleas, lice, ticks and mites, capable of reproduction only within the living cells of its host. In shape, they are either very short rods or spheres; considered to be more closely related to viruses than to bacteria. Although not harmful to their arthropod hosts, rickettsiae can cause severe disease in man and other mammals, if transmitted by a bite of the arthropod. ↑ VIRUS

JC073 endospore (*n.*) A spore formed inside a vegetative cell, *e.g.* a bacterial cell; the cell material outside the spore disintegrates before the spore is released. ↑ CAUSATIVE AGENT

JC074 blight (*n.*) Plant disease caused by viruses or fungi; it stops growth and causes death of parts of the plant. ↓ ROT[1] · MOSAIC[3] ↑ CAUSATIVE AGENT

JC075 rot[1] (*n.*) Plant disease caused by fungi or bacteria, leading to death of the plant. ↑ BLIGHT

JC076 mosaic[3] (*n.*) A viral plant disease in which the leaves are spotted brown, yellow or black, with a mosaic pattern. ↑ BLIGHT

JC077 bactericidal (*adj.*) Describes a chemical substance that causes the death of a bacterium (micro-organism), *e.g.* disinfectants are bactericidal. Such substances are of importance both *in vivo* and *in vitro*. □ *antiseptics have a bactericidal action* ↓ BACTERIOSTATIC · VIRAL ↑ CAUSATIVE AGENT

JC078 bacteriostatic (*adj.*) Describes a chemical substance which prevents growth of bacteria in an otherwise suitable environment, but does not kill them, *e.g.* antibiotics produce a bacteriostatic effect. —***bacteriostasis*** (*n.*) ↑ BACTERICIDAL

JC079 germicidal (*adj.*) (G.S.) Describes a chemical substance causing the death of a germ. ↑ BACTERICIDAL (Sn)

JC080 viral (*adj.*) Of or to do with viruses, *e.g.* ***a*** a viral infection; ***b*** viral replication. ↑ BACTERICIDAL

JC081 bacilliform (*adj.*) Describes a straight rod-shaped bacterium other than a bacillus; it does not form endospores, *e.g.* the bacilliform bacteria causing tuberculosis. ↑ CAUSATIVE AGENT

JC082 injury (*n.*) Damage or an instance of damage to tissues or organs; a general term giving no detail, *e.g.* an injury to a leg may be a wound, a contusion, a laceration, or a broken bone. —***injured*** (*adj.*) INJURE (*v.*) ↓ WOUND · PUS · SCAR · HEAL · SOUND[1] ↑ PATHOGEN

JC083 wound (*n.*) A hole in a tissue such as the skin, made by a sharp instrument, such as a knife, teeth, or claws. Plants and animals can both be wounded; it is the result of an unnatural event, such as an attack. Wounds can be healthy, healing, suppurating, deep, or shallow. —***wound*** (*v.*) ***wounded*** (*adj.*) ↓ ABRASION · CONTUSION · SCRATCH[1] · LESION · BRUISE ↑ INJURY

JC084 abrasion (*n.*) An injury to the skin caused by a hard, rough, object; the skin is lacerated, and there may be contusion as well. —ABRASIVE (*adj.*) ***abrade*** (*v.*) ↑ WOUND → ABRASIVE

JC085 contusion (*n.*) The site of an injury caused by a blow on the skin; the skin is not ruptured, but blood-vessels under the skin are ruptured. A contusion is marked by the black and blue appearance of the skin, caused by blood escaping from the ruptured blood-vessels. —***contused*** (*adj.*) ***contuse*** (*v.*) ↓ BRUISE (Sn) ↑ WOUND → RUPTURE

JC086 scratch[1] (*n.*) A very narrow, superficial wound, made by claws, nails or a sharp instrument. ↑ WOUND

JC087 lesion (*n.*) A part of a tissue, often epithelial, marked by a diseased change in structure; in many cases, it causes a small wound or a small fissure in the tissue. ↑ WOUND

JC088 bruise (*n.*) (G.S.) Alternative term for CONTUSION. —***bruised*** (*adj.*) ***bruise*** (*v.*)

JC089 pus (*n.*) A thick, yellowish-white liquid composed of dead white blood cells, dead bacteria and dead tissue. ↓ SUPPURATION · PURULENCE · SCAB · ANTISEPTIC · SEPSIS · ASEPSIS · ANTISEPSIS ↑ INJURY

JC090 suppuration (*n.*) The process or condition of tissues at the site of a wound breaking down and pus being formed. —***suppurating*** (*adj.*) ***suppurate*** (*v.*) ↑ PUS

JC091 purulence (*n.*) The formation of pus. —PURULENT (*adj.*) ↑ PUS

JC092 scab (*n.*) A cover of dried blood and pus formed over a wound; its function is to prevent bleeding and invasion by bacteria. ↑ PUS

JC093 antiseptic (*n.*) A chemical substance used in antisepsis; antiseptics are milder in action than disinfectants; they are applied to the skin and to open wounds, *e.g.* iodine in solution is an antiseptic. ↑ PUS

JC094 sepsis (*n.*) The condition resulting from bacteria invading a wound. Sepsis also

arises from foci of infection in specific tissues of the body which are infected; the pathogens gain access to the blood causing general ill-health. —SEPTIC (*adj.*) ↓ ASEPSIS ↑ PUS

JC095 asepsis (*n.*) A condition in which an individual is kept free from sepsis. Asepsis is used in surgical operations to prevent infection; all objects used are sterile, and the surroundings are clean and as sterile as possible. —ASEPTIC (*adj.*) ↑ PUS

JC096 antisepsis (*n.*) A process in which bacteria infecting wounds are eliminated, usually by the use of chemical substances (antiseptics). —ANTISEPTIC (*n.*) ***antiseptic*** (*adj.*) ↑ PUS

JC097 scar (*n.*) **1** (In mammals) a mark left after a wound heals, usually a white line or area on the skin. **2** (In all animals) a mark where a part has been removed. **3** (In plants) a mark on the stem left after the fall of a scale leaf or a petiole, or a mark on a plant of a healed wound. —***scar*** (*v.*) ↓ SCAR TISSUE · CICATRIX ↑ INJURY

JC098 scar tissue (*n.*) (In mammals) a fibrous tissue with few capillaries, no sweat glands, no hair follicles, and no nerve endings; it is the tissue finally formed to heal a wound. ↑ SCAR

JC099 cicatrix (*n.,pl.* **cicatrices**) Alternative term for SCAR. —***cicatrical*** (*adj.*) ↑ SCAR

JC100 heal (*v.i.*) (Of a wound) to become sound, *i.e.* skin grows over the wound with no infection remaining in the wound. —***healed*** (*adj.*) ↓ LACERATE · SCRATCH[2] · SOUND[1] ↑ INJURY

JC101 lacerate (*v.t.*) **1** To cause an irregularly shaped wound, usually with several cuts. **2** To crush tissues. —***laceration*** (*n.*) ***lacerated*** (*adj.*) ↑ HEAL → LACERATE

JC102 scratch[2] (*v.t.*) To draw claws or nails across the skin, either to make a scratch or to relieve itching. ↑ HEAL

JC103 sound[1] (*adj.*) **1** (Of a tissue or organ) without injury, *e.g.* his heart is sound (it does not suffer from any disease or injury). **2** (Of a wound) healed completely, *e.g.* after a wound has healed, the skin and tissues become sound. —***soundness*** (*n.*) ↓ PURULENT · SEPTIC · ASEPTIC · TRAUMATIC ↑ INJURY

JC104 purulent (*adj.*) Of, to do with, or composed of pus. —PURULENCE (*n.*) ↑ SOUND[1]

JC105 septic (*adj.*) Describes a wound which has been invaded by bacteria; pus is formed and healing is delayed. ↓ ASEPTIC (I) ↑ SOUND[1]

JC106 aseptic (*adj.*) Kept free from bacteria causing sepsis; describes a condition or a method of operation. ↑ SOUND[1] · SEPTIC (I)

JC107 traumatic (*adj.*) Of, to do with, or caused by, a wound. —***trauma*** (*n.*) ↑ SOUND[1]

JC108 symptom (*n.*) A condition of the body felt by an individual when he is suffering from disease or injury; it is part of the evidence used in diagnosis. Symptoms of disease include pain, headache, coughing, constipation and paralysis. To contrast **signs** and **symptoms**: the signs of a disease are observed by a doctor without questioning the patient, but the patient has to describe his symptoms on being questioned. —SYMPTOMATIC (*adj.*) ↓ FEVER · CONVULSION · ITCH · SIGN · LUBRICATE[2] · SYMPTOMATIC ↑ PATHOGEN

JC109 fever (*n.*) **1** A pathological condition in which the body temperature is raised above normal (37°C); it is usually accompanied by an increased rate of heart beat. **2** A name for certain diseases which produce feverish conditions, *e.g.* scarlet fever. —***feverish*** (*adj.*) ↓ HEADACHE · COUGH · DIARRHOEA · CONSTIPATION · PYREXIA · MALAISE ↑ SYMPTOM

JC110 headache (*n.*) Continuous pain in the head. ↑ FEVER

JC111 cough (*n.*) The action of opening the windpipe suddenly to expel compressed air from the lungs and the noise accompanying this action. A cough is caused by irritation in the respiratory system; coughing expels phlegm and mucus. —***cough*** (*v.*) ↑ FEVER

JC112 diarrhoea (*n.*) A condition in which there is frequent passing of faeces consisting mainly of liquid. ↑ FEVER

JC113 constipation (*n.*) Infrequent evacuation of faeces; the faeces are hard and dry and there is difficulty in defaecation. —***constipated*** (*adj.*) ↑ FEVER

JC114 pyrexia (*n.*) The clinical term for fever. ↑ FEVER

JC115 malaise (*n.*) A general condition of the human body in which the individual is not completely healthy, but also has no definite signs or symptoms, such as headache, pain or fever. ↑ FEVER

JC116 convulsion (*n.*) A violent spasm of muscles, usually over most of the body; it may be accompanied by unconsciousness. It is caused by malfunctioning of the brain arising from disease, or from damage to the brain. —***convulsed*** (*adj.*) ↓ PARALYSIS · INSOMNIA · EPILEPSY ↑ SYMPTOM

JC117 paralysis (*n.*) The loss of nervous reaction and of movement in any part of the body, *e.g.* in paralysis of the legs, the sensory nerves do not conduct impulses to the spinal cord and the motor nerves are incapable of moving the legs. —***paralytic*** (*adj.*) ***paralyse*** (*v.*) ↑ CONVULSION

JC118 tetany (*n.*) A condition in which the muscles suffer sudden attacks of tetanus; the condition is present in a number of diseases. ↑ CONVULSION → TETANUS

JC119 insomnia (*n.*) The continuous condition of being unable to sleep; sometimes a symptom of disease or physiological malfunction. —***insomniac*** (*n.*) ***insomniac*** (*adj.*) ↑ CONVULSION

JC120 epilepsy (*n.*) A chronic disease of the brain causing infrequent periods of loss of consciousness, and sometimes accompanied by convulsions; the individual is liable to exhibit these signs and symptoms without warning. Evidence suggests the disease is heritable. —***epileptic*** (*adj.*) ***epileptic*** (*n.*) ↑ CONVULSION → APOPLEXY

JC121 itch (*n.*) An irritation of the skin,

caused by a variety of agents; it gives rise to a voluntary or reflex action of rubbing or scratching the skin. —***itchy*** (*adj.*) ***itch*** (*v.*) ↓ CHAFING ↑ SYMPTOM

JC122 chafing (*n.*) The action of skin being rubbed by an object until the skin becomes painful. —***chafe*** (*v.*) ***chafed*** (*adj.*) ↑ ITCH

JC123 tumour (*n.*) A swelling caused by an abnormal growth of new tissue upon normal tissue; the abnormal growth may not be diseased, but it may cause pain by pressing against other tissues or organs, and it may interfere with the functions of such tissues or organs. ↓ OBESITY ↑ SYMPTOM

JC124 obesity (*n.*) The condition in which excess fat is deposited under the skin, all over the body. —***obese*** (*adj.*) ↑ TUMOUR

JC125 sign (*n.*) An observable condition of the body, caused by a pathological condition; it is part of the evidence used in diagnosis. Signs of disease include pallor, oedema, inflammation, rash, jaundice, changes in pulse rate. ↓ PALLOR · OEDEMA[1] · DROPSY · INFLAMMATION · RASH · JAUNDICE[1] · BUBO · EMACIATION · WASTAGE ↑ SYMPTOM

JC126 pallor (*n.*) An unnatural lack of colour in the skin, caused by constriction of the blood vessels in the skin arising from various causes, *e.g.* shock, making the individual look white or grey. —***pallid*** (*adj.*) ↑ SIGN

JC127 oedema[1] (*n.*) A diseased condition in which excessive watery liquid accumulates in the tissue spaces, especially under the skin, giving a swollen appearance to the body. ↑ SIGN

JC128 dropsy (*n.*) An alternative term for OEDEMA[1].

JC129 inflammation (*n.*) (In vertebrates) the local reaction to an injury. The reaction includes, ***a*** dilation of blood-vessels to increase the supply of blood; ***b*** passage of blood proteins and plasma through capillary walls to tissue spaces; ***c*** increased supply of white blood cells to the injured part. The local tissues swell, become red, and are hot and painful. Inflammation is a protective mechanism to provide phagocytes and antibodies to combat invading bacteria. Inflammation is also caused by histamine in allergic reactions. —***inflamed*** (*adj.*) ***inflame*** (*v.*) ↑ SIGN → ALLERGY

JC130 rash (*n.*) A mass of red spots which appear suddenly on the skin; a sign of disease or of allergic reaction □ *the man broke out in a rash* ↑ SIGN

JC131 jaundice[1] (*n.*) A diseased condition in which the skin, the urine, and the sclerotic coat of the eyes, become a deep yellow; it is caused by the presence of excess bile pigments in the blood and tissues, and is a sign of damage to the liver. —***jaundiced*** (*adj.*) ↑ SIGN

JC132 bubo (*n.,pl.* **buboes**) An inflamed and much swollen lymphatic gland. —***bubonic*** (*adj.*) ↑ SIGN

JC133 emaciation (*n.*) The condition of the body of an animal (usually a mammal) being extremely thin, so that the bones can be seen under the skin. The condition is caused by starvation or disease. —***emaciated*** (*adj.*) ↑ SIGN

JC134 wastage (*n.*) Gradual loss in strength of a muscle, usually accompanied by a reduction in girth of the muscle. Wastage can also occur in tissues, resulting in a reduction in total volume. ↑ SIGN

JC135 lubricate[2] (*v.t.*) To put a liquid between two structures which touch, so that the structures can move smoothly over each other without rubbing, *e.g.* the serous fluid which lubricates the pleurae of the lungs and prevents them from rubbing. —***lubrication*** (*n.*) ***lubricated*** (*adj.*) ↑ SYMPTOM

JC136 symptomatic (*adj.*) Of or to do with symptoms; describes a state, or action, associated with a cause, *e.g.* a cough is symptomatic of bronchial disorders (bronchial disorders cause the cough, but also cause other conditions as well; a cough can be caused by agents other than bronchial disorders, *i.e.* a cough and bronchial disorders are associated; but neither is conclusive evidence for the other, only symptomatic). ↑ SYMPTOM

JC137 clinic (*n.*) **1** A place where medical students are taught by observing the work of clinicians. **2** A hospital for out-patients only; a doctor or a nurse may be in attendance. **3** A private hospital or similar institution. —CLINICIAN (*n.*) CLINICAL (*adj.*) ↓ CLINICIAN · DIAGNOSIS · SURGERY · DRUG · NARCOTIC · DIAGNOSE · CLINICAL · SUPPRESSIVE → PATHOGEN

JC138 clinician (*n.*) An expert in the diagnosis and treatment of diseases. ↓ PHYSICIAN · SURGEON · PATIENT · IN-PATIENT · OUT-PATIENT ↑ CLINIC

JC139 physician (*n.*) A person who treats ill-health, disease, and other pathological conditions, by the administration of drugs and antibiotics. ↑ CLINICIAN

JC140 surgeon (*n.*) A person who practices surgery. ↑ CLINICIAN → SURGERY

JC141 patient (*n.*) A person receiving medical treatment from a physician or surgeon, for illness, disease, or any other pathological condition. ↑ CLINICIAN

JC142 in-patient (*n.*) A patient who stays in a hospital. ↑ CLINICIAN

JC143 out-patient (*n.*) A patient who visits a hospital or clinic for treatment and returns home. ↑ CLINICIAN

JC144 diagnosis (*n.*) **1** The discrimination of a pathological condition in an individual human being or animal. **2** A precise description of an organism, which differentiates it from those of any other species, genus, or a larger group. —***diagnose*** (*v.*) ***diagnostic*** (*adj.*) ↓ CLINICAL ANALYSIS · CLINICAL THERMOMETER[2] ↑ CLINIC

JC145 clinical analysis (*n.*) Analysis of sputum, urine, faeces, sweat, blood, cerebro-spinal fluid, or any other substance or tissue from a human or animal body, for the purpose of diagnosing disease. ↑ DIAGNOSIS

JC146 clinical thermometer[2] (*n.*) A thermometer used to record the body temperature of a human being, or of any other mammal. ↑ DIAGNOSIS

JC147 surgery (*n.*) A branch of medical science concerned with the treatment of pathological conditions by the amputation, excision, stretching and training into new positions, of parts of the body. —***surgical*** (*adj.*) ↓ PHARMACY · PHARMACOLOGY ↑ CLINIC

JC148 pharmacy (*n.*) **1** The knowledge of drugs and their use in pathological conditions. It includes a knowledge of the preparation of medicine by the mixing of drugs and other chemical substances. **2** The place where drugs are prepared. —***pharmacist*** (*n.*) ↑ SURGERY

JC149 pharmacology (*n.*) The study of, and research into, the action of chemical substances on living tissues and on individual organisms, including man. The study leads to the discovery of new drugs. —***pharmacologist*** (*n.*) ***pharmacological*** (*adj.*) ↑ SURGERY

JC150 drug (*n.*) **1** A chemical substance that has a physiological or psychological effect on a living body, used for clinical or medical purposes, usually to alleviate signs or symptoms or to cure the disease, *e.g.* quinine is a drug used to combat malaria. Some drugs are self-administered for the psychological effects they produce; such drugs are often addictive and dangerous. **2** (G.S.) A dangerous drug, *e.g.* a narcotic □ *a drug is administered to a patient; an individual takes a drug, i.e. takes it into the body* —***drug*** (*v.*) ↓ OINTMENT · ANTIBIOTIC · EXTRACT[2] · INHALANT[1] · ANTIDOTE · PLACEBO · MEDICINE ↑ CLINIC

JC151 ointment (*n.*) A mixture of fat or soft wax, and a chemical substance, used for clinical purposes, *e.g.* for putting on skin, a wound, or a scratch, to reduce or prevent infection. ↑ DRUG

JC152 antibiotic (*n.*) A substance produced by a living micro-organism (usually bacteria or fungi); it is capable of diffusion into the surroundings and is toxic to, or inhibits the growth of, other organisms, particularly micro-organisms. Antibiotics have been obtained from many micro-organisms, particularly the actinomycetes, and are used in the treatment of bacterial infections; their normal effect is to produce bacteriostasis. —ANTIBIOTIC (*adj.*) ↑ DRUG

JC153 extract[2] (*n.*) A liquid or solid substance purified from a crude form of the substance. The extract is usually removed from the crude mixture of substances by the action of water or ethanol. Extracts are also made from animal and plant tissues and contain a required substance in a more concentrated form, *e.g.* thyroid extract contains thyroxin in a more concentrated form than the original thyroid tissue. Many drugs are used in the form of extracts ↑ DRUG → EXTRACT[1]

JC154 inhalant[1] (*n.*) A drug taken by inhaling. ↑ DRUG → INHALE

JC155 antidote (*n.*) A substance that neutralizes the effects of a poison. ↑ DRUG → POISON

JC156 placebo (*n.*) A substance of no medical value administered to a patient to make him think he is being given a drug; he is satisfied with the treatment and it helps his recovery. ↑ DRUG

JC157 medicine (*n.*) Any substance administered to a patient in the treatment of disease □ *the patient takes his medicine twice daily* —***medicinal*** (*adj.*) ↑ DRUG

JC158 narcotic (*n.*) A chemical drug causing sleep, or loss of sensation, when absorbed into the body; used clinically to relieve pain or alleviate disease. It can also be used to produce hallucination, and when taken in excess, causes convulsions and death; this is a misuse and the reason why narcotics are dangerous drugs. Some narcotics are addictive, *e.g.* morphine and opium. —***narcotic*** (*adj.*) ↓ NARCOSIS · NARCOTISM · ADDICTION · ADDICT · HALLUCINATION · NARCOMA ↑ CLINIC

JC159 narcosis (*n.*) A state of coma or of being only half awake, caused by narcotic drugs. —NARCOTIC (*n.*) ***narcotic*** (*adj.*) ↑ NARCOTIC

JC160 narcotism (*n.*) Addiction to narcotic drugs. ↑ NARCOTIC

JC161 addiction (*n.*) The state of being used to taking a drug, and being unable to live without it; usually applied to narcotic drugs. —ADDICT (*n.*) ADDICTED (*adj.*) ADDICTIVE (*adj.*) ↑ NARCOTIC → ADDICTIVE

JC162 addict (*n.*) A person addicted to taking drugs. ↑ NARCOTIC

JC163 hallucination (*n.*) The experience of sensations originating solely in the brain, often accompanied by a form of coma (narcoma) in which the individual is possibly aware of his surroundings, but does not react to stimuli. —***hallucinate*** (*v.*) ***hallucinogenic*** (*adj.*) ↑ NARCOTIC → COMA

JC164 narcoma (*n.*) Alternative term for NARCOSIS (↑).

JC165 diagnose (*v.t.*) **1** To discriminate, by observation of signs and symptoms, and by clinical analysis, between various possible pathological conditions and to decide which particular disease is afflicting an individual. **2** To give a precise description of an organism. —DIAGNOSIS (*n.*) ***diagnostic*** (*adj.*) ↓ ADMINISTER · SUPPRESS[2] ↑ CLINIC

JC166 administer (*v.t.*) To supply a drug to an individual, making sure the quantity is correct, and the time interval for giving the drug is correct, and to make sure the individual swallows the drug, *i.e.* to supply a drug for a known purpose and to see it is consumed. —***administration*** (*n.*) ↑ DIAGNOSE

JC167 suppress[2] (*v.t.*) To end an activity, or process, and to prevent it from starting again; to prevent an activity or process from starting. A biological activity or process remains latent, and may start when suppression stops, *e.g.* when cholera is suppressed in a country, the disease is first eliminated

and any fresh outbreak then prevented (when suppressive measures stop, cholera may break out again). —***suppression, suppressant*** (*n.*) SUPPRESSIVE (*adj.*) ↑ DIAGNOSE

JC168 clinical (*adj.*) Of or to do with a clinic; in particular, clinical work is to do with the observation, the identification, and the treatment of diseases, as opposed to medical work, which is carried out in a laboratory, or prophylactic work, which is carried out in town and country. ↓ SUBCLINICAL ↑ CLINIC

JC169 subclinical (*adj.*) Describes effects produced in an animal which cannot be identified as definite signs and symptoms of definite pathological conditions, *e.g.* ***a*** a lack of a vitamin may not be severe enough to cause the signs and symptoms of the deficiency disease associated with the vitamin (there are some signs and symptoms); ***b*** the effects of a pathogen before it gives rise to the clinical signs and symptoms of a specific disease are sub-clinical, *i.e.* the general condition of the body does not allow the disease to be diagnosed, although the individual is obviously not in full health. ↑ CLINICAL

JC170 suppressive (*adj.*) Describes an agent that suppresses, *e.g.* a suppressive drug for malaria suppresses the infection in an individual, *i.e.* it prevents any infection from developing. ↓ THERAPEUTIC · ADDICTIVE · ADDICTED ↑ CLINIC

JC171 therapeutic (*adj.*) Describes any form of help in curing or alleviating disease, without describing specifically the manner in which the cure or alleviation is effected, *e.g.* the therapeutic value of drinking from certain natural springs. —***therapeutics*** (*n.*) ↑ SUPPRESSIVE

JC172 addictive (*adj.*) Describes any drug, which when taken, causes addiction. ↑ SUPPRESSIVE

JC173 addicted (*adj.*) Describes a person in a state of addiction. To contrast **addictive** and **addicted**: a person is addicted to a drug; a drug is addictive. ↑ SUPPRESSIVE

JC174 degenerative disease (*n.*) A disease in which a person becomes functionally less active; usually arises in old age. ↓ CANCER → PATHOGEN

JC175 cancer (*n.*) A general term applied to a carcinoma or a sarcoma. The typical symptoms are: a tumour or swelling, a discharge, pain, an upset in the function of an organ, general weakness and loss of weight. —***cancerous*** (*adj.*) ↓ CARCINOMA · SARCOMA · CARCINOGEN ↑ DEGENERATIVE DISEASE → TUMOUR

JC176 carcinoma (*n.,pl.* **carcinomata**) A malignant growth of abnormal epithelial cells. ↑ CANCER → MALIGNANT

JC177 sarcoma (*n.,pl.* **sarcomata**) A malignant growth of abnormal cells in connective tissue. ↑ CANCER

JC178 carcinogen (*n.*) Any substance considered to produce cancer, *e.g.* certain steroids and some hydrocarbons produce local cancerous growths when injected into animals. —***carcinogenic*** (*adj.*) ↑ CANCER

JC179 deficiency disease (*n.*) A disease caused by a severe lack of vitamins, mineral salts, or essential amino acids, in a diet. ↓ PROTEIN-CALORIE MALNUTRITION · NIGHT-BLINDNESS · BERI-BERI · RICKETS · SCORBUTIC → PATHOGEN

JC180 protein-calorie malnutrition (*n.*) A deficiency disease which varies between the two extremes of kwashiorkor and marasmus, exhibiting signs and symptoms intermediate between those of the two diseases. ↓ PCM · KWASHIORKOR · MARASMUS ↑ DEFICIENCY DISEASE → MALNUTRITION

JC181 PCM (*abbr.*) Abbreviation for protein-calorie malnutrition. ↑ PROTEIN-CALORIE MALNUTRITION

JC182 kwashiorkor (*n.*) A deficiency disease caused by a lack of protein arising from a deficient quantity, or a deficient quality, or both, of protein. It occurs in children between the ages of 6 months and 4 years; its signs and symptoms include: loss of appetite and weight, oedema, soft hair which loses its pigmentation, failure of growth. ↑ PROTEIN-CALORIE MALNUTRITION

JC183 marasmus (*n.*) A deficiency disease caused by lack of carbohydrate; the lack arises from an inadequate intake of food, or intestinal infections and worm infestations causing deficient assimilation, or all these causes. The signs and symptoms include a ravenous appetitie, shrunken appearance, body dehydration, wastage of muscles. ↑ PROTEIN-CALORIE MALNUTRITION

JC184 night-blindness (*n.*) A condition in which a person sees normally by day, but his vision at night is poor; it is caused by a deficiency of visual purple in the rods of the retina, which, in turn, is most usually, but not always, caused by a deficiency of retinol (vitamin A) in the diet. Compare **xerophthalmia**, in which keratinization of the epithelial cells of the cornea leads to softening of the cornea, and eventually to blindness. ↓ NYCTALOPIA ↑ DEFICIENCY DISEASE → XEROPHTHALMIA

JC185 nyctalopia (*n.*) Alternative term for NIGHT-BLINDNESS. —***nyctalopic*** (*adj.*) ↑ NIGHT-BLINDNESS

JC186 beri-beri (*n.*) A disease caused by a deficiency of thiamin in the diet. The symptoms include neuritis and general malaise; the signs include oedema, wastage of the muscles, and emaciation. Circulatory failure may lead to death. ↓ PELLAGRA · SCURVY ↑ DEFICIENCY DISEASE → THIAMIN

JC187 pellagra (*n.*) A disease caused by a deficiency of nicotinic acid, or of tryptophan in the diet. The skin becomes brown and scaly, lesions occur in the mouth and on the tongue; diarrhoea is common, and the patient is often mentally disturbed. ↑ BERI-BERI → NICOTINIC ACID

JC188 scurvy (*n.*) A disease caused by a severe deficiency of vitamin C (ascorbic acid) in the diet. The signs are acute gingivitis, loosening of teeth, and subcutaneous

bleeding, particularly in the gums. —***scorbutic*** (*adj.*) ***antiscorbutic*** (*adj.*) ↑ BERI-BERI → VITAMIN C · GINGIVITIS

JC189 rickets (*n.sing.*) A bone disease in young children caused by failure to absorb calcium salts and deficiency of calciferol in the diet; the bones become soft owing to lack of calcification and the limbs are bent and twisted under the weight of the child. —***rachitic*** (*adj.*) ↓ OSTEOMALACIA[2] · RACHITIS · GOITRE ↑ DEFICIENCY DISEASE → CALCIFEROL

JC190 osteomalacia[2] (*n.*) A bone disease in adults, especially in pregnant women, in which the bones become soft owing to deficient absorption of calcium salts, probably related to lack of calciferol in the diet. Calcium ions are absorbed from bone into the blood, and decalcification of the bone causes the softness. ↑ RICKETS

JC191 rachitis (*n.*) Alternative term for RICKETS.

JC192 goitre (*n.*) An enlargement of the thyroid gland in the neck, caused by, ***a*** a severe deficiency of iodine in the diet; ***b*** inability of the thyroid gland to secrete enough thyroid hormone; ***c*** secretion of too much hormone by the thyroid gland. ↑ RICKETS

JC193 scorbutic (*adj.*) Of or to do with scurvy, *e.g.* a scorbutic diet is one causing scurvy. ↓ ANTISCORBUTIC (An) ↑ DEFICIENCY DISEASE

JC194 antiscorbutic (*adj.*) Describes food which alleviates scurvy. ↑ SCORBUTIC (An)

Hygiene

JD001 hygiene (*n.*) The personal methods used to keep healthy through cleanliness and care of the body, *e.g.* hygiene of the digestive system includes: cleanliness of hands and utensils when eating, uncontaminated food and drink, a sufficient and balanced diet. —***hygienic*** (*adj.*) ↓ CLEANLINESS · VENTILATION · DISINFECT · UNHYGIENIC · HYGIENIC · SANITATION · PROPHYLAXIS → ANTIGEN

JD002 cleanliness (*n.*) The state of being clean, *i.e.* free of dirt; it does not mean free from pathogens, but the chance of infection is reduced. ↓ DISINFESTATION · FUMIGATION[2] · DISINFECTANT ↑ HYGIENE

JD003 disinfestation (*n.*) To remove body parasites, such as fleas and lice, from a human body, from clothes, or from a place, such as a room or house. —***disinfest*** (*v.*) ↑ CLEANLINESS

JD004 fumigation[2] (*n.*) The process of disinfestation by the use of fumes, causing the death of parasites, *e.g.* sulphur dioxide fumes kill body parasites; sulphur dioxide is a fumigant and its use is fumigation. —***fumigant*** (*n.*) ***fumigate*** (*v.*) ↑ CLEANLINESS

JD005 disinfectant (*n.*) A chemical substance used for disinfection; stronger in action than antiseptics, usually corrosive to the skin; it destroys bacteria by lysis. —***disinfection*** (*n.*) ↑ CLEANLINESS → ANTISEPTIC

JD006 ventilation (*n.*) The methods used to ensure a supply of cool fresh air to a building □ *the ventilation of the house is adequate, but of the bedroom is inadequate* —***ventilated*** (*adj.*) VENTILATOR (*n.*) ↓ VENTILATOR · AIR-CONDITIONING[2] · KATA-THERMOMETER

JD007 ventilator (*n.*) Any device which improves the flow of fresh air into a building. ↑ VENTILATION

JD008 air-conditioning[2] (*n.*) A process for reducing the humidity of air, or for cooling air; it includes filtering air to remove dust and fumes. —***air-conditioning*** (*n.*) ***air-conditioned*** (*adj.*) ↑ VENTILATION

JD009 kata-thermometer (*n.*) A thermometer with a large bulb, containing ethanol, and a scale which measures the loss in heat per cm^2 of area; it is placed in a ventilated room to measure the efficiency of ventilation in removing heat from a person's body. The thermometer is heated to a given point, and the rate of cooling recorded for a 5°C drop in temperature. ↑ VENTILATION

JD010 disinfect (*v.t.*) To destroy bacteria and other pathogens (but not body parasites) when they are outside a human or animal body, *e.g.* in dust, on clothes. —DISINFECTANT (*n.*) ***disinfected*** (*adj.*) ↓ CLEANSE ↑ HYGIENE

JD011 infest (*v.t.*) (Of parasites, such as fleas and lice) to cover the body of an animal or plant. A place, such as a room or a bed, can also be infested with parasites, *e.g.* bedbugs and ticks. The term implies an excessive number of parasites present, with a probable harmful effect on health. —***infestation*** (*n.*) ***infested*** (*adj.*) ↑ DISINFECT

JD012 cleanse (*v.t.*) To make as clean as possible. ↑ DISINFECT

JD013 unhygienic (*adj.*) Describes any practice that does not follow the rules of hygiene. ↓ DOMESTIC · OVERCROWDED

JD014 domestic (*adj.*) Of or to do with the home. ↑ UNHYGIENIC

JD015 overcrowded (*adj.*) Describes the condition of too many organisms in one space; it can lead to the death of weaker organisms; also describes the condition in which causative agents of disease and other parasites can be transmitted readily from one individual to another. ↑ UNHYGIENIC

JD016 hygienic (*adj.*) Describes any practice that follows the rules of hygiene. ↓ CLEAN ↑ HYGIENE

JD017 clean (*adj.*) Describes objects or surroundings which are free from dirt and dust. —CLEANLINESS (*n.*) CLEANSE (*v.*) ↑ HYGIENIC

JD018 sanitation (*n.*) The measures taken to keep living places clean, and to reduce

the chances of infection or the spread of disease. It includes adequate drainage, a good ventilation system, proper disposal of sewage. Hygiene and sanitation resemble each other closely, with hygiene referring to personal measures, and sanitation referring to domestic and public measures. —SANITARY (*adj.*) ↓ POLLUTION[1] · DRAIN[2] · REFUSE · POLLUTE · UNPOLLUTED · INSANITARY ↑ HYGIENE

JD019 pollution[1] (*n.*) The presence in soil, water or air of substances harmful to health, or objectionable to human beings or animals, *e.g.* ***a*** sewage in the soil can be harmful to health (if the sewage is contaminated)—it is pollution in the soil; ***b*** pollution of the atmosphere in towns includes the presence of sulphur dioxide (sulphur dioxide is harmful to health, and objectionable to human beings); ***c*** the pollution of river water by oil. —***polluted*** (*adj.*) POLLUTE (*v.*) ↓ CONTAMINATION ↑ SANITATION

JD020 contamination (*n.*) The presence in any substance (particularly food or water) of causative agents of disease, such as bacteria or protozoa, is contamination, *e.g.* the presence of cholera bacteria in water is contamination of the water. —CONTAMINATED (*adj.*) CONTAMINATE (*v.*) ↑ POLLUTION[1]

JD021 drain[2] (*n.*) A small pipe conducting sewage and the water flowing off the soil. —DRAIN[1] (*v.*) ↓ SEWER · SEWERAGE · SEWAGE FARM · ACTIVATED SLUDGE · SEWAGE ↑ SANITATION

JD022 sewer (*n.*) A large pipe conducting sewage from several drains. ↑ DRAIN[1]

JD023 sewerage (*n.*) The system of sewers in an area, or the method of removing sewage from a community. ↑ DRAIN[1]

JD024 sewage farm (*n.*) A place where sewage is treated to make it harmless; water is returned to rivers, and the solid products are made into fertilizer. ↑ DRAIN[1]

JD025 activated sludge (*n.*) Sludge containing bacteria and protozoa used in one method of sewage disposal. Activated sludge is added to sewage and the mixture aerated; the micro-organisms multiply and purify the sludge. The sludge is allowed to settle and an increased amount of activated sludge is formed; some of this is used to inoculate the next lot of sludge, the rest is disposed of. ↑ DRAIN[1]

JD026 sewage (*n.*) The liquid, containing mainly faeces and urine from latrines, which flows in drains. ↑ DRAIN[1]

JD027 refuse (*n.*) Dust and the unwanted remains of food, *e.g.* skins, leaves, rinds, etc.; anything rejected from a house when cleaning it. ↑ SANITATION

JD028 pollute (*v.t.*) To cause pollution in, *e.g.* smoke from fires pollutes the atmosphere. —POLLUTION, ***pollutant*** (*n.*) ***polluted*** (*adj.*) ↓ CONTAMINATE ↑ SANITATION

JD029 contaminate (*v.t.*) To cause contamination in, *e.g.* a housefly walking over food contaminates the food, as its feet leave bacteria on the food. ↑ POLLUTE

JD030 unpolluted (*adj.*) Without observable pollution. ↓ UNCONTAMINATED · SANITARY ↑ SANITATION

JD031 uncontaminated (*adj.*) Without observable contamination. ↑ UNPOLLUTED

JD032 sanitary (*adj.*) Describes conditions in which sanitation is good. ↓ INSANITARY (Ag) ↑ UNPOLLUTED

JD033 insanitary (*adj.*) Describes conditions in which sanitation is poor or is lacking. ↑ SANITATION

JD034 polluted (*adj.*) Describes soil, water, or air, in which substances harmful to health, or objectionable to human beings, are present. Soil, etc., can be polluted, but it is not necessarily contaminated. ↑ INSANITARY · POLLUTION

JD035 contaminated[2] (*adj.*) Describes food, liquids, solids, earth and water when contamination is present. ↑ INSANITARY

JD036 prophylaxis (*n.*) The combined measures used to prevent the spread of disease, *e.g.* prophylaxis against malaria includes, ***a*** residual spraying with D.D.T. of houses; ***b*** oiling of stagnant water; ***c*** taking suppressive drugs; ***d*** sleeping under mosquito nets; □ *prophylaxis against intestinal diseases includes improvement of sanitation* —PROPHYLACTIC (*adj.*) ↓ MEASURE[2] · INSECTICIDE · RESIDUAL SPRAYING · PROPHYLACTIC ↑ HYGIENE

JD037 measure[2] (*n.*) An action or activity carried out with a definite purpose, *e.g.* using proper sewage disposal (an activity) is a useful measure to prevent the spread of dysentery (a definite purpose). ↑ PROPHYLAXIS

JD038 insecticide (*n.*) Any chemical substance used to kill insects. —***insecticidal*** (*adj.*) ↓ CONTACT INSECTICIDE · MOLLUSCICIDE · D.D.T ↑ PROPHYLAXIS → PESTICIDE

JD039 contact insecticide (*n.*) A poison which kills insects when it penetrates their cuticle or blocks their spiracles. ↑ INSECTICIDE

JD040 molluscicide (*n.*) A chemical substance put in water to kill snails or other molluscs living and breeding in the water. Used in prophylaxis against bilharzia flukes which require a snail as a host during part of their life-cycle. ↑ INSECTICIDE

JD041 D.D.T. (*abbr.*) A chemical compound [formula: $(C_6H_4Cl)_2{:}CH.CCl_3$] used to kill insects; it is a stomach and contact insecticide. ↑ INSECTICIDE

JD042 residual spraying (*n.*) Spraying a mixture of oil and D.D.T. (or other insecticide) on the walls of houses; insects absorb the D.D.T. when they alight on a wall and die later; a method used to kill mosquitoes in the control of malaria. ↓ SANITATION CONTROL ↑ PROPHYLAXIS

JD043 sanitation control (*n.*) Spraying oil on stagnant water to prevent mosquito larvae and pupae from respiring; this kills the larvae and pupae and reduces the mosquito population; used in the control of malaria and other mosquito-borne diseases. ↑ RESIDUAL SPRAYING

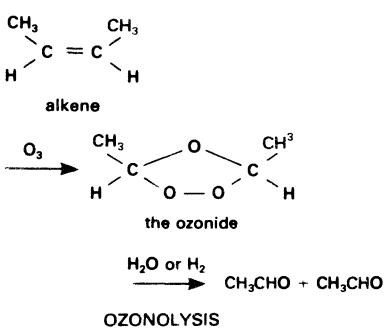
JD044 prophylactic (*n.*) Any substance, object, or treatment, which reduces the spread of disease, *e.g.* plasmoquin is a prophylactic drug which prevents malarial parasites developing in the body. —PROPHYLACTIC (*adj.*) ↑ PROPHYLAXIS

Chemical Reactions

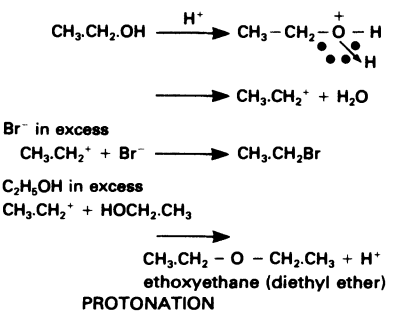
KA001 reaction type (*n.*) Chemical reactions can be classified in types in a number of different ways. They may be classified, ***a*** according to the active chemical agent in the reaction, *e.g.* halogenation, hydrolysis, hydrogenation, ozonolysis, etc.; ***b*** according to the physical agent, *e.g.* pyrolysis, electrolysis; ***c*** according to the product, *e.g.* polymerization, alkylation; ***d*** according to the mechanism of the reaction, *e.g.* substitution, addition, rearrangement, etc. Within this group there are sub-types of reaction; ***e*** according to the thermodynamic considerations, *e.g.* exothermic, endothermic; ***f*** according to kinetic considerations, *e.g.* slow, fast, zero order, first order, etc., reactions. ↓ ADDITION[2] · DEHYDROGENATION · SUBSTITUTION · DEHYDRATE · DERIVE[2] · HYDRATED[2] · REPLACEABLE[2] → DECOMPOSITION · DECOMPOSE · REFORMING · STABILIZE · OPTIMUM · STABLE · SYNTHETIC · EXTRACTION · EQUATION · REACTIVITY · CYCLE · CORRODE · HOMOGENOUS · RATE · MECHANISM · REDOX PROCESS · EQUILIBRIUM

KA002 addition[2] (*n.*) A chemical process in which two substances react together to form a single new substance, *e.g.* ***a*** the reaction of ammonia gas with hydrogen chloride gas to form ammonium chloride is a process of addition; ***b*** the reaction of ethene (ethylene) with bromine to form 1,2-dibromoethane is a process of addition. —***addition*** (*adj.*) ↓ OZONOLYSIS · PROTONATION ↑ REACTION TYPE

KA003 hydrogenation (*n.*) The process of adding hydrogen to a molecule, usually directly, using a catalyst and suitable conditions of temperature and pressure, *e.g.* vegetable oils are hardened by hydrogenation. ↑ ADDITION[2] → DEHYDROGENATE (Cn)



KA004 ozonolysis (*n.*) The process in which ozone (O_3) is added across a double bond in an alkene, forming an ozonide, and decomposition of the ozonide by water or hydrogen. ↑ ADDITION[2]



KA005 protonation (*n.*) The adding of a proton to an electron-rich atom in a compound, *e.g.* in the reaction between ethanol and hydrobromic acid, the hydrogen ion (proton) joins the ethanol at the oxygen atom. This is an important step in the mechanism of the preparation of bromoethane or ethoxyethane (diethyl ether). The oxygen has two unused pairs of electrons. ↑ ADDITION[2]

KA006 dehydrogenation (*n.*) The process of removing combined hydrogen from a compound, usually with a heated catalyst. ↓ DEHYDRATION · CONDENSATION[2] ↑ REACTION TYPE → HYDROGENATE (Cn)

KA007 dehydration (*n.*) **1** The process of removing water from a substance to dry it. **2** The process by which the elements of one or more molecules of water are removed from the molecule of a compound, *e.g.* ***a*** dehydration is the process by which ethene C_2H_4 is formed from ethanol C_2H_5OH in the presence of aluminium oxide at 300°C; ***b*** carbon monoxide can be obtained by dehydration of methanoic acid by concentrated sulphuric acid. ↑ DEHYDROGENATION → HYDRATION (Cn)

KA008 condensation[2] (*n.*) A type of reaction in which two or more molecules combine to form a larger molecule by the elimination of a smaller molecule, such as H_2O, HCl, NH_3, *e.g.* ***a*** ethanal and hydrazine combine to form ethanal hydrazone; ***b*** in condensation polymers, molecules of H_2O, HCl, NH_3, HCN may be eliminated. ↑ DEHYDROGENATION

KA009 substitution (*n.*) A process in which one or more atoms in a molecule are replaced directly or indirectly by other atoms, *e.g.* ***a*** one of the hydrogens of benzene can be replaced by chlorine to form chlorobenzene; ***b*** one of the hydrogen atoms of ethane can be replaced by a chlorine atom to form chloroethane:

$$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$$

ethane chloroethane

—***substitution*** (*adj.*) ***substitute*** (*v.*) ↓ SE · SN1 · SN2 · NITRATION · HALOGENATION · DISPLACEMENT[2] · DERIVATIVE ↑ REACTION TYPE → SULPHONATION · METHYLATION

KA010 SE reaction (*n.*) A substitution reaction in which the attacking agent is an electrophilic reagent. The nitration and sulphonation of benzene are examples of electrophilic substitution. ↑ SUBSTITUTION

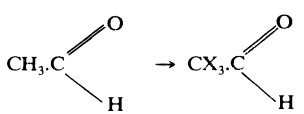
KA011 SN1 reaction A substitution reaction which is a first order reaction and in which the reagent is a nucleophilic reagent. The hydrolysis of 2-bromo-2-methyl propane $(CH_3)_3.C.Br$ by the OH^- ion is first order with respect to Br^- but zero order with respect to OH^-. SN1 reactions are favoured by polar solvents. ↑ SUBSTITUTION

KA012 SN2 reaction (*n.*) A second order substitution reaction in which the active reagent is nucleophilic. The reaction between sodium ethoxide and bromoethane; this reaction is favoured by a non-polar solvent. The nucleophilic reagent is $C_2H_5O^-$. ↑ SUBSTITUTION

KA013 nitration (*n.*) The process of adding or substituting the group $—NO_2$, *e.g.* benzene is converted by nitration to nitrobenzene:

$$C_6H_6 \rightarrow C_6H_5NO_2$$

—***nitrate*** (*n.*) ↑ SUBSTITUTION



HALOGENATION

KA014 halogenation (*n.*) The process of substituting a halogen atom for a hydrogen atom in an organic compound, *e.g.* the halogenation of ethanal. ↑ SUBSTITUTION

KA015 chlorination (*n.*) Halogenation when the halogen used is chlorine. In the case of chlorine it is often convenient to use a chlorinating agent such as phosphorus pentachloride, phosphorus trichloride, thionyl chloride ($SOCl_2$), or sulphuryl chloride (SO_2Cl_2):

$$C_2H_5OH + PCl_5 \rightarrow C_2H_5Cl + POCl_3 + HCl$$
$$C_2H_5OH + SOCl_2 \rightarrow C_2H_5Cl + SO_2 + HCl.$$

Chlorination of fatty acids in which the chlorine substitutes for a hydrogen atom on the chain may be effected by direct chlorination with chlorine gas. ↑ SUBSTITUTION · HALOGENATION

KA016 bromination (*n.*) Halogenation when bromine is the halogen used, *e.g.* the bromination of benzene:

$$C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr.$$

In this reaction a carrier is used to 'carry' the bromine. ↑ SUBSTITUTION · HALOGENATION

KA017 iodination (*n.*) The process of halogenation when iodine is the halogen used, *e.g.* iodination of propanone (acetone):

$$CH_3.CO.CH_3 + I_2 \rightarrow CH_3.CO.CH_2I + HI.$$

↑ SUBSTITUTION · HALOGENATION

KA018 sulphonation (*n.*) The substitution of the $—SO_2.OH$ group for a hydrogen atom in a carbon chain or ring. Rings are more easily sulphonated than straight chains, *e.g.* benzene, a C_6H_6 ring, can be sulphonated by hot concentrated sulphuric acid to form benzene sulphonic acid. ↑ SUBSTITUTION

KA019 methylation (*n.*) A process in which a methyl group is attached to another compound. Methylating agents are diazomethane CH_2N_2, iodomethane CH_3I, and dimethylsulphate $(CH_3)_2SO_4$. ↑ SUBSTITUTION

KA020 displacement[2] (*n.*) **1 Mechanical displacement** is the collection of a gas over water where the gas displaces the water. A dense gas may be collected by displacement (pushing out) of air upwards. **2 Chemical displacement** is the freeing of an element from a compound by replacement with another element, *e.g.* a metal is said to displace hydrogen from an acid (N.B. this is properly an out-of-date concept). Displacement of bromine by chlorine from potassium bromide can occur in solution. This is more properly an exchange of electrons between Cl and Br. ↑ SUBSTITUTION

KA021 derivative (*n.*) The term implies an initial compound or structure from which other compounds are made (derived) directly or indirectly by substitution of one or more atoms by another atom(s) or group of atoms, *e.g.* ethane is the initial compound; chloroethane, ethanol, ethanal, ethanoic acid (acetic acid) are derivatives of ethane. —***derivation*** (*n.*) DERIVE (*v.*) ↑ SUBSTITUTION

KA022 dehydrate (*v.t.*) **1** To remove water from a substance so as to dry it. **2** To remove the elements of water, *e.g.* to dehydrate ethanol to produce ethene:

$$C_2H_5OH - H_2O \rightarrow C_2H_4$$

ethanol ethene

—DEHYDRATION (*n.*) DEHYDRATED (*adj.*) ↑ REACTION TYPE → HYDRATE · ANHYDROUS

KA023 derive[2] (*v.t.*) To obtain one compound, substance, structure, or theory, from another, either directly or indirectly. When A is changed to B in such a way that it is clearly seen that B has been obtained from A, then B is derived from A, *e.g.* ***a*** chloromethane is derived from methane—both the method of carrying out the reaction and the structure of

chloromethane, show methane to be the origin of chloromethane; ***b*** $PV = RT$ is the general Gas Law; it is derived from Boyle's Law and Charles' Law, and it can be seen that both these laws are the origin of the Gas Law. —DERIVATIVE, ***derivation*** (*n.*) ***derived*** (*adj.*) ↑ DERIVATIVE · REACTION TYPE → OBTAIN · FORM · PRODUCE · DERIVED UNIT · DERIVE[1]

KA024 replaceable[2] (*adj.*) Able to be replaced, *e.g.* of the 4 hydrogen atoms in a molecule of ethanoic acid (acetic acid), only one is replaceable by an atom of a metal. —***replace*** (*v.*) ↑ REACTION TYPE

KA025 hydrated[2] (*adj.*) Describes a compound, atom, ion, etc., bound to molecules of water. Ionic compounds which crystallize from a solution in water may have water molecules in their crystals. This water is built in as part of the crystal structure. Such compounds are called hydrated and are salt hydrates. Ions in solution may also be hydrated, *e.g.* $[Cu(H_2O)_4]^{2+}$. —***hydrate, hydration*** (*n.*) ***hydrate*** (*v.*) ↓ CARBONATED ↑ REACTION TYPE → ANHYDROUS (I)

KA026 carbonated (*adj.*) Describes a liquid which has carbon dioxide dissolved in it under pressure. ↑ HYDRATED

KA027 decomposition (*n.*) A chemical process in which a compound splits up into two or more elements and/or compounds which do not recombine when the agent ceases to act, *e.g.* ***a*** zinc carbonate when heated decomposes into zinc oxide and carbon dioxide; ***b*** sodium nitrate when heated sufficiently decomposes into sodium nitrite and oxygen; ***c*** when a direct current of electricity is passed through molten sodium chloride, the sodium chloride decomposes to form sodium and chlorine. ↓ THERMAL DECOMPOSITION · HYDROLYSIS · DISSOCIATION · THERMAL DISSOCIATION · ASSOCIATION[4] ↑ REACTION TYPE

KA028 thermal decomposition (*n.*) The process of producing chemical decomposition by raising the temperature of a compound, as distinct from other methods of decomposition, *e.g.* lead (II) carbonate when heated decomposes into lead (II) oxide and carbon dioxide, an example of thermal decomposition. ↑ DECOMPOSITION

KA029 hydrolysis (*n.*) The chemical reaction of a compound with water to produce decomposition into two or more other compounds. Hydrolysis occurs with salts of weak acids and/or weak bases, *e.g.* sodium ethanoate undergoes hydrolysis in solution:

$NaOOCCH_3 + H_2O$
sodium ethanoate
$\rightleftharpoons NaOH + CH_3COOH$
sodium hydroxide — ethanoic acid

It also occurs with esters (it is the reverse of esterification):

$C_2H_5OOCCH_3 + H_2O$
ethyl ethanoate
$\rightleftharpoons C_2H_5OH + CH_3COOH$
ethanol — ethanoic acid

Some salts show acid or alkaline reactions because of hydrolysis. $Na_2CO_{3(aq)}$ has an alkaline reaction. $CuSO_{4(aq)}$ has an acid reaction:

$Cu(H_2O)^{2+}_{4(aq)} \rightarrow Cu(OH)(H_2O)^{+}_{3(aq)} + H^{+}_{(aq)}$

↑ DECOMPOSITION

KA030 dissociation (*n.*) A reversible process in which, under specified conditions, a compound (ionic or covalent) or molecule separates into simpler chemical species, *e.g.* the dissociation of ammonium chloride into ammonia and hydrogen chloride when heated, (in this case the specified condition is temperature). —***dissociate*** (*v.*) ***dissociated*** (*adj.*) ↑ DECOMPOSITION

KA031 thermal dissociation (*n.*) The splitting up of a compound, by raising its temperature, into substances of smaller mass than itself; the substances combine again when the temperature is lowered, *e.g.* ammonium chloride undergoes thermal dissociation into ammonia and hydrogen chloride when heated. Contrast **thermal decomposition** in which the substances do not recombine. ↑ DECOMPOSITION

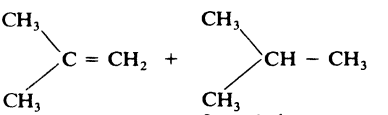
KA032 association[4] (*n.*) The joining together of two or more like molecules to form a single molecule of higher molecular mass. —***associate*** (*v.*) ***associated*** (*adj.*) ↑ DECOMPOSITION

KA033 reforming (*n.*) A process in which molecules of straight-chain hydrocarbons are cyclized and dehydrogenated:

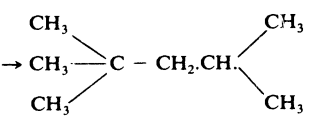
heptane $\xrightarrow{-H_2}$ methyl cyclohexane
$\xrightarrow{-3H_2}$ toluene (methyl benzene).

This process is important as one of those used in producing high-grade motor fuel from the petrol fractions obtained during the distillation of crude oil. ↓ ALKYLATION → POLYMERIZATION

KA034 alkylation (*n.*) A process in which an alkane and an alkene combine to form a branched chain alkane by an addition reaction.



methyl propene — 2-methyl propane (isobutane)



2,2,4-trimethyl pentane (iso-octane)

A catalyst of concentrated sulphuric acid is used at 5°C. ↑ REFORMING

KA035 pyrolysis (*n.*) Chemical decomposition of organic compounds by heat, *e.g.* the cracking process used for breaking down

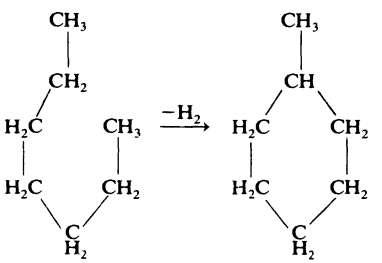
long-chain alkanes is a special form of pyrolysis. ↑ REFORMING

KA036 decompose (*v.t.,i.*) **1** (*v.t.*) To cause a pure chemical substance to change into products each of less mass than itself. This change may be caused by temperature, electric current, micro-organisms, or light (radiation). **2** (*v.i.*) (Of a compound) to change into two or more simpler products □ *calcium carbonate when strongly heated decomposes into calcium oxide and carbon dioxide; silver chloride in sunlight decomposes into silver and chlorine* —***decomposition*** (*n.*) ↓ LIBERATE[1] → REACTION TYPE

KA037 liberate[1] (*v.t.*) To set free by chemical action; the term is often applied to gases formed during a reaction, *e.g.* ***a*** hydrogen is liberated when zinc reacts with dilute sulphuric acid; ***b*** chlorine is liberated at the anode during electrolysis of concentrated sodium chloride. ↑ DECOMPOSE

KA038 stabilize (*v.t.*) To make stable or maintain in a stable state. ↓ CYCLIZE ↑ THERMAL DECOMPOSITION

KA039 cyclize (*v.t.,i.*) **1** (*v.i.*) To change from straight chain molecules to cyclic (ring form) compounds, *e.g.* heptane changes to methyl cyclohexane when heated under pressure at 500°C. Dehydrogenation also takes place.



heptane methyl cyclohexane

2 (*v.t.*) To cause to change in this way. ↑ STABILIZE

KA040 optimum (*adj.*) Describes the most favourable possible conditions for a reaction, *e.g.* the optimum temperature for the Haber process is about 450°C; this is the temperature at which the best yield of ammonia is obtained. ↓ LABILE · REVERSIBLE → REACTION TYPE

KA041 labile (*adj.*) Liable to change chemically or physically. A labile compound is one that easily decomposes. ↑ OPTIMUM

KA042 reversible (*adj.*) Describes a chemical reaction which may go in either direction depending upon the conditions, *e.g.* ammonia and hydrogen chloride combine at room temperature to form ammonium chloride. If ammonium chloride is heated it dissociates to form ammonia and hydrogen chloride.

$$NH_{3(g)} + HCl_{(g)} \rightarrow NH_4Cl_{(s)} \quad \text{(room temperature)}$$

$$NH_4Cl_{(s)} \xrightarrow{\text{heat}} NH_{3(g)} + HCl_{(g)}$$

$$\text{or } NH_3 + HCl \underset{\text{heat}}{\overset{\text{room temp.}}{\rightleftharpoons}} NH_4Cl$$

↑ OPTIMUM

KA043 stable[1] (stabile) (*adj.*) Remaining unchanged in form, structure or character under certain stated conditions, *i.e.* not readily changing or decomposing under the named conditions, *e.g.* copper (II) carbonate is stable at room temperature. —***stability, stabilizer*** (*n.*) ***stabilize*** (*v.*) ↓ THERMOSTABLE · INERT[2] → REACTION TYPE · UNSTABLE (I)

KA044 thermostable (*adj.*) A compound which does not decompose or lose its characteristic properties when heated. ↑ STABLE[1] · LABILE

KA045 inert[2] (*adj.*) **1** A substance which has no active chemical effect, *e.g.* ***a*** tetrachloromethane (carbon tetrachloride) is an inert solvent; ***b*** nitrogen is sometimes used as an inert atmosphere during welding; ***c*** starch is sometimes used as an inert diluent in pills. **2** Not acting chemically with other elements, or compounds, to form compounds, *e.g.* the inert gases He, Ne, A, Xe, and Kr. (N.B. although this was once thought to be true not all elements of Group O are inert.) □ *an inert electrode has no chemical effect in electrolysis* —***inertness*** (*n.*) ↑ STABLE → ACTIVE (I)

KA046 synthetic (*adj.*) Describes a compound built up in the laboratory or in an industrial process, rather than obtained naturally. Sometimes the compound exists in nature or results from a natural process, *e.g.* vinegar is formed naturally from wine by souring – a synthetic vinegar can be made as dilute ethanoic (acetic) acid. Vitamin B_1 can be obtained from a number of natural sources. It can be made in the laboratory as a synthetic substance, thiamine. Sometimes the synthetic compound has properties similar to, but not necessarily identical with, those of the natural compound (the one found in nature), *e.g.* natural rubber as opposed to synthetic rubber; natural fibres as opposed to synthetic fibres. —***synthesize*** (*v.*) ***synthesis*** (*n.*) → REACTION TYPE

KA047 extraction[3] (*n.*) The process whereby a substance is removed or obtained from a mixture, usually by dissolving it out in a solvent. A common operation is extraction of a substance from water by partition between the water and a solvent not miscible with water, *e.g.* phenol is partially soluble in water at ordinary temperatures. It is much more soluble in ether. The aqueous solution is shaken with ether to extract the phenol. —***extract*** (*v.*) ↓ FIXATION · YIELD → REACTION TYPE · PARTITION

KA048 fixation (*n.*) A process by which a

gaseous element (usually nitrogen) can be converted into a compound containing the element so that the element may be used The direct combination of nitrogen and hydrogen to form ammonia (Haber process) is a nitrogen fixation Another method is the reaction of atmospheric nitrogen with calcium carbide to form calcium cyanamide which can be used as a fertilizer The fixation of nitrogen by bacteria on root modules of legumes is a natural process which makes an absorbable compound for a plant ↑ EXTRACTION[3]

KA049 yield (*n.*) The actual amount of a pure substance obtained during a preparation or manufacturing process. Often the term is used to give a comparative statement for stoichiometric yield with actual yield, *e.g.* ***a*** the Haber process gives a yield of about 10% —this is a poor yield; ***b*** the yield of aniline in the preparation was 25 grammes ↑ EXTRACTION[3]

KA050 octane number (*n.*) A number (0–100) by which a petrol is characterized for its value as a fuel in internal-combustion engines The value is determined by experiment The scale of octane numbers runs from heptane (C_7H_{16}, straight chain) at 0 to (2,2,4-trimethyl pentane), (iso-octane, branched chain) at 100. ↑ EXTRACTION[3] → CRACKING · REFORMING

KA051 equation (*n.*) A chemical equation is a statement in symbols of a chemical change or reaction. Equations may represent action at the atom/molecule level, *e.g.*

$$2KClO_3 \xrightarrow{heat} 2KCl + 3O_2$$

can be a statement in symbols showing that 2 molecules of potassium chlorate when heated decompose to form 2 molecules of potassium chloride and 3 molecules of oxygen. The equation may also represent the process in terms of moles: 2 moles of $KClO_3$ ion units when heated form 2 moles of KCl ion units and 3 moles of oxygen molecules. Ionic equations represent reaction in terms of the ions in solution which are directly concerned in a reaction excluding other ions present (spectator ions), *e.g.* the silver nitrate solution reaction with sodium chloride solution:

$$Ag^+_{(aq)} + Cl^-_{(aq)} \rightarrow Ag^+.\ Cl^-_{(s)}.$$

→ REACTION TYPE

KA052 reactivity (*n.*) The disposition to take part in a chemical reaction, often used in relation to elements in the electrochemical series or the activity series. It can also be used of compounds. It is in contrast with **inertness** □ *high reactivity; low reactivity* —***reaction*** (*n.*) ***react*** (*v.*) ***reactive*** (*adj.*) ↓ ACTIVITY[2] · ACTIVITY SERIES · ACTIVATION ENERGY · REACTION PROFILE · AFFINITY

KA053 activity[2] (*n.*) A particular element may undergo a reaction with other elements or with a selection of compounds. There are two sets of facts to be considered, ***a*** the number of reactions the element will undergo; ***b*** the vigour of the reactions. From these separate statements of reactivity of the element, a generalization may be made which is a statement of the activity of the element, *e.g.* chlorine has a high activity as, ***a*** it reacts with many elements and compounds, and, ***b*** many of its reactions are vigorous In **reactivity,** the disposition of a substance to enter into reaction with other substances is considered. In activity the general disposition of the substance to act on other substances is considered □ *sodium has a high activity, gold has a low activity* —***activation*** (*n.*) ***activate*** (*v.*) ***active*** (*adj.*) ↑ REACTIVITY → ACT ON · REACT · INERTNESS REACTION · ACTION · REACTIVE

KA054 activity series (*n.*) The activity of the elements can be compared by experimental observations such as the displacement of one element by another or the reactivity of the element with a stated compound, such as water The elements can be listed in order of chemical activity The result is an activity series for the metals, and an activity series for the nonmetals. From these series, predictions, at an elementary level, can be made concerning any particular reaction of the element The order of the elements in the activity series corresponds, with a few exceptions, to the order of the elements in the electrochemical series. The order of the common metals, in descending activity, is K, Na, Ca, Mg, Zn, Fe, Sn, Pb, (H), Cu, Hg, Ag, Au. Note that hydrogen can be included in the metal series. The order of common nonmetals, in descending activity, is F, Cl, Br, I. ↑ REACTIVITY → ELECTROCHEMICAL SERIES

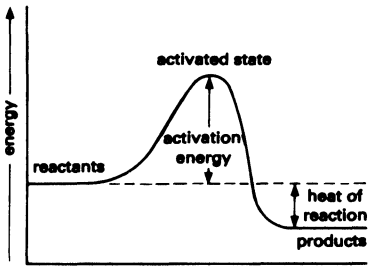
KA055 activation energy (*n.*) The additional energy which must be supplied to a reaction for the reaction to occur. ↑ REACTIVITY → THERMOCHEMISTRY · MAXWELL DISTRIBUTION EQUATION

KA056 reaction profile (*n.*) A diagram (see next page) showing the relation between the potential energy of a system and the reaction coordinate. This latter represents in a general way the potential course of the reaction. ↑ REACTIVITY

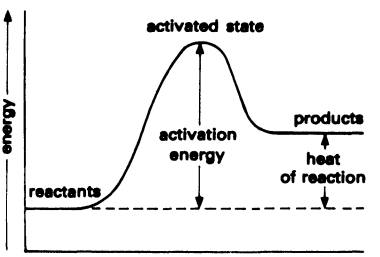
KA057 affinity (*n.*) An attraction, applied in chemistry to compounds and elements which react very readily indeed, even violently. *E.g.* ***a*** Sulphur trioxide has a great affinity for water – the reaction produces a large amount of heat. ***b*** Chlorine has an affinity for hydrogen; it reacts directly with it in sunlight; it also forms bonds with hydrogen in compounds causing other bonds to break, *e.g.* chlorine reacts with water to form hydrochloric acid and oxygen □ *A has an affinity for B* ↑ REACTIVITY

KA058 cycle (*n.*) A complete set of events which can happen again and again, *e.g.* ***a*** the carbon dioxide cycle shows how carbon dioxide enters and leaves the atmosphere by a series of processes; ***b*** the nitrogen cycle is a similar set of reactions involving transfer of nitrogen between the atmosphere and living organisms; ***c*** certain cycles which are part of the energy processes in the human body. → REACTION TYPE

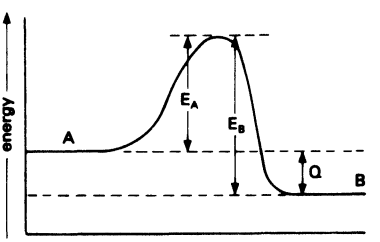
KA059 corrode[2] (*v.t.,i.*) **1** (*v.t.*) To destroy slowly by chemical reaction the surface of a metal by forming on the surface a corrosion product which is a compound of the metal. The surface becomes pitted and the tensile strength of the metal may be reduced. **2** (*v.i.*) To undergo such a reaction. Metals corrode when they are in contact with certain gases in the air, for example oxygen, sulphur dioxide, and hydrogen sulphide. —***corrosion*** (*n.*) ***corrosive*** (*adj.*) ↓ SMOULDER → REACTION TYPE · RUST (H) · TARNISH (Sn) · CORROSIVE



reaction path for an exothermic reaction



reaction path for an endothermic reaction



reaction path for a reversible reaction
$A \rightleftharpoons B + Q$

REACTION PROFILES

KA060 smoulder (*v.i.*) To burn slowly without great rise in temperature and without flame. ↑ CORRODE[2] → BURN

KA061 homogeneous (*adj.*) Of the same kind or nature throughout, *i.e.* having at all points the same composition and properties. A homogeneous mixture is one which is the same in all its parts. A homogeneous system has all members in the same state. In a homogeneous reaction all the reactants and catalysts are in the same state, *e.g.*

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

A homogeneous catalyst is one used when the reactants and catalysts are all in the same state, *e.g.* an acid (H^+ aq.) as a catalyst in hydrolysis of an ester (all in liquid state). —***homogeneity*** (*n.*) ↓ HETEROGENEOUS (I)

KA062 heterogeneous (*adj.*) Of different kinds; not of the same kind or nature. A heterogeneous mixture does not have the same composition in every part of the mixture. A heterogeneous system contains substances in different states, *e.g.* the system:

$$CaCO_{3(s)}/CaO_{(s)}/CO_{2(g)}$$

is a heterogeneous system. A heterogeneous reaction is one in which the reactants and products are in different states, *e.g.*

$$CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}.$$

A heterogeneous catalyst is one which is not in the same state as the reacting mixture, *e.g.* NH_3 and air over platinum. —***heterogeneity*** (*n.*) ↑ HOMOGENEOUS (I)

KA063 redox process (*n.*) A chemical process in which one reactant is oxidized and the other reduced. Redox processes are often reversible and commonly one reactant (ion or atom) loses electrons and the other reactant (ion or atom) gains electrons, *e.g.*

a $Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$

i.e. the displacement of copper metal from solution by zinc.

b $5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$.

c Reactions at the anode or cathode during electrolysis or in cells. ↓ OXIDATION · REDUCTION · REDOX REACTION → REACTION TYPE

KA064 oxidation (*n.*) **1** A process by which oxygen is added or hydrogen is removed, *e.g.* the oxidation of copper to copper (II) oxide. **2** A process by which electrons are removed from an ion or atom, or group of atoms, *e.g.* ***a*** the oxidation of Fe^{2+} to Fe^{3+}; ***b*** the oxidation of a copper atom to a copper ion, $Cu \rightarrow Cu^{2+}$. **3** A process by which the oxidation number (state) of an element is increased, *e.g.* the oxidation of iron (II) to iron (III). —***oxidizing*** (*adj.*) ***oxidant*** (*n.*) ***oxidize*** (*v.*) ↓ OXIDIZING AGENT → REDOX PROCESS · REDUCTION (P)

KA065 oxidizing agent A substance which effects oxidation by adding oxygen, by removing hydrogen, or by accepting an electron, *e.g.* ***a*** oxygen reacts with copper to form copper oxide – oxygen is the oxidizing agent; ***b*** chlorine removes hydrogen from hydrogen sulphide – chlorine is the oxidizing agent; ***c*** nitric acid accepts electrons from Fe^{2+} to form Fe^{3+} – nitric acid is the oxidizing agent. ↓ OXIDANT · OXIDIZING ATMOSPHERE · BACTERIAL OXIDATION · AUTOOXIDATION ↑ OXIDATION → REDUCING AGENT (Cn)

KA066 oxidant (*n.*) An alternative term for an OXIDIZING AGENT (↑).

KA067 oxidizing atmosphere (*n.*) A gaseous environment which can bring about oxidation or which, more usually, can prevent reduction. A similar term could also apply to a solution, *i.e.* an oxidizing environment. ↑ OXIDIZING AGENT

KA068 bacterial oxidation (*n.*) An oxidation process which requires the presence of a specific bacterium, *e.g.* the oxidation of ethanol to ethanoic acid (acetic acid) by *Bacterium aceti.* ↑ OXIDIZING AGENT

KA069 auto-oxidation (*n.*) An oxidation reaction which proceeds only when another oxidation reaction is occurring simultaneously in the same system, *e.g.* hydrogen peroxide is formed during the slow oxidation of turpentine in air. This may then oxidize a solution of potassium iodide (or $I^-_{(aq)}$.). By a similar process zinc or lead may be oxidized in the presence of water by oxygen. ↑ OXIDIZING AGENT

KA070 reduction (*n.*) **1** A process by which oxygen is removed or hydrogen added, *e.g.* the reduction of copper (II) oxide to copper. **2** A process by which electrons are added to an ion or atom, or group of atoms, *e.g.* ***a*** the reduction of $Fe^{3+} \rightarrow Fe^{2+}$; ***b*** the reduction of $S \rightarrow S^{2-}$; ***c*** the reduction of $Cu^{2+} \rightarrow Cu$. **3** A process by which oxidation number (state) of an element is decreased, *e.g.* ***a*** the reduction of iron (III) to iron (II); ***b*** the reduction of plumbate (IV) to plumbate (II). —***reduce*** (*v.*) ***reducing*** (*adj.*) ↓ REDUCING AGENT ↑ REDOX PROCESS · OXIDATION → CATHODIC REDUCTION

KA071 reducing agent (*n.*) A substance which effects reduction by removing oxygen, by adding hydrogen, or by donating an electron, *e.g.* ***a*** hydrogen reacts with copper oxide to form copper – hydrogen is the reducing agent; ***b*** hydrogen sulphide adds hydrogen to chlorine – hydrogen sulphide is the reducing agent; ***c*** tin (II) chloride solution contains the ion $(SnCl_4)^{2-}$ which donates electrons to Fe^{3+} to form Fe^{2+} – tin (II) chloride is the reducing agent:

$$SnCl_4^{2-} \rightarrow SnCl_4 + 2e \text{ (electrons donated)}$$
$$Fe^{3+} + 1e \rightarrow Fe^{2+}.$$

↓ REDUCING ATMOSPHERE ↑ REDUCTION · OXIDIZING AGENT (Cn)

KA072 reducing atmosphere A gaseous environment which can prevent oxidation. With solutions the term **reducing environment** could be used. ↑ REDUCING AGENT

KA073 redox reaction (*n.*) A reaction which involves an oxidizing agent and a reducing agent with a transfer of electrons from reducing agent to oxidizing agent, *e.g.* potassium manganate (VII) in acid solution reacting with iron (II) sulphate solution:

$$MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$$

↓ REDOX POTENTIAL[1] · DISPROPORTIONATION

KA074 redox potential[1] (*n.*) The standard redox potentials of the metals give a numerical comparison of the strength of the metals as reducing agents or the strength of their ions as oxidizing agents. The standard electrode potentials of metals are also their standard redox potential. Similarly redox potentials for the change of one ion to another can be obtained, *e.g.*

$$Fe^{3+} + 1e \rightarrow Fe^{2+}.\ V + 0.76$$
$$MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O.\ V + 1{\cdot}52$$

↓ REDOX SERIES[1] · REDOX EQUATION ↑ REDOX REACTION → ELECTRODE POTENTIAL

KA075 redox series[1] (*n.*) A series based on redox potentials showing the relative strengths of a chemical species as an oxidizing or reducing agent in relation to other members of the series which are below it or above it in the series. ↑ REDOX POTENTIAL[1] → ELECTROCHEMICAL SERIES

KA076 redox equation (*n.*) An equation representing a redox reaction, *e.g.*

$$\underset{\text{oxidizing agent}}{2KMnO_4} + 8H_2SO_4 + \underset{\text{reducing agent}}{10FeSO_4} \rightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$$

or

$$\underset{\text{oxidizing agent}}{MnO_4^-} + 8H^+ + \underset{\text{reducing agent}}{5Fe^{2+}} \rightarrow Mn^{2+} + 4H_2O + 5\ Fe^{3+}$$

↑ REDOX POTENTIAL[1]

KA077 disproportionation (*n.*) A chemical reaction in which a substance suffers simultaneous oxidation and reduction, one atom (ion or molecule) being oxidized while the other atom (ion or molecule) is reduced, *e.g.* ***a*** under suitable conditions the copper (I) ion (Cu^+) undergoes disproportionation to $Cu + Cu^{2+}$; one Cu^+ ion loses an electron to another Cu^+ ion; ***b*** a free radical $C_2H_5\cdot$ loses a hydrogen atom to another $C_2H_5\cdot$ radical to form C_2H_4 and C_2H_6. —***disproportionate*** (*v.*) ↑ REDOX PROCESS · REDOX REACTION

Chemical Equilibrium

KB001 equilibrium[1] (*n.*) When the rate of a forward reaction and the rate of the reverse reaction in a chemical process are equal then a state of equilibrium exists □ *the reaction is in equilibrium; the reaction is in a state of equilibrium* ↓ DYNAMIC EQUILIBRIUM · LE CHATELIER PRINCIPLE · IONIC PRODUCT → RATE OF REACTION

KB002 dynamic equilibrium (*n.*) A balanced state of continual change, *e.g.* ***a*** water and water vapour at constant temperature in a closed system; molecules move from liquid to vapour and vapour to liquid; ***b*** the equilibrium set up between sulphur dioxide and oxygen on the one hand and sulphur trioxide on the other – SO_2 and O_2 molecules are reacting and changing to SO_3 molecules, while SO_3 molecules are decomposing to SO_2 molecules and O_2 molecules. ↓ REVERSIBLE REACTION · LAW OF MASS ACTION · EQUILIBRIUM CONSTANT · EQUILIBRIUM MIXTURE

KB003 reversible reaction (*n.*) A reaction which can be made to proceed in the opposite direction by slight changes in the conditions, *e.g.* the reaction of nitrogen and hydrogen to form ammonia is a reversible reaction. Increase in temperature encourages the decomposition of ammonia while increase in pressure increases the formation of ammonia:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

A reversible reaction under constant conditions is in dynamic equilibrium. ↑ DYNAMIC EQUILIBRIUM

KB004 law of mass action (*n.*) A statement put forward in 1864 by Guldberg and Waage which stated that 'rate of reaction at constant temperature is proportional to the products of the active masses of the reacting substances'. The usefulness of the statement turns on the interpretation of **active mass**. For gaseous reactions partial pressures are taken as proportional to active mass. For reactions in solution, concentrations are taken. In a reversible reaction the rates in each direction will be equal, and this leads to the expression for the equilibrium constant of a reaction. ↑ DYNAMIC EQUILIBRIUM

KB005 equilibrium constant (*n.*) For a system xA + yB $\rightleftharpoons$ pC + qD the equilibrium constant K is:

$$K = \frac{[C]^p.[D]^q}{[A]^x.[B]^y}$$

By convention the square brackets indicate concentration. The concentration of reactants form the denominator of the fraction. The equilibrium constant changes with temperature according to the following equation:

$$\frac{d \ln K}{dT} = \frac{\Delta H}{rT^2}$$

↑ DYNAMIC EQUILIBRIUM

KB006 equilibrium mixture (*n.*) The mixture of reactants and products when equilibrium is reached in a reversible reaction. ↑ DYNAMIC EQUILIBRIUM

KB007 Le Chatelier's principle (*n.*) This principle applies to chemical systems in equilibrium. It is usually stated as: *any system in equilibrium shifts the equilibrium, when subjected to any constraint, in the direction which tends to nullify the effect of the constraint.* In the reaction

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$
$$1 \text{ mol} \quad 3 \text{ mol} \quad 2 \text{ mol}$$

it is clear that the reaction results in a volume change from the equivalent of 4 moles to 2 moles. The application of pressure (the restraint) will have the result that the effect (reduction in volume) will be nullified by the reaction moving to the right. In the reaction

$$N_2 + O_2 \rightleftharpoons 2NO; \Delta H = +180 \text{ kJ}$$

the reaction to the right absorbs heat. Putting heat energy into the system will make the equilibrium shift to the right. High temperature favours a higher concentration of NO (nitrogen oxide) in the equilibrium mixture. ↑ EQUILIBRIUM[1]

KB008 ionic product (*n.*) This is concerned with equilibrium because for weak electrolytes there is an equilibrium between the ions and the unionized molecule, *e.g.* for ethanoic acid

$$CH_3.COOH \rightleftharpoons CH_3CO.O^- + H^+.$$

The ionic product is the product of the concentrations (mol dm^{-3}) of the ions, *i.e.* $[CH_3CO.O^-]\,[H^+]$.

↓ IONIC PRODUCT OF WATER · SOLUBILITY PRODUCT · pH ↑ EQUILIBRIUM[1]

KB009 ionic product of water (*n.*) Water ionizes slightly according to the following equation:

$$H_2O \rightleftharpoons H^+ + OH^-.$$

The **ionic product** will be $[H^+]\,[OH^-]$. This can be shown to be 10^{-14} mol^2 dm^{-6}. As the concentration of H^+ and OH^- must be equal, the value for the H^+ concentration will be 10^{-7} mol dm^{-3}. ↑ IONIC PRODUCT

KB010 solubility product (*n.*) This is also an ionic product but of a slightly different kind. It is the ionic product of the ions in a saturated solution of a sparingly soluble salt.

$$AgCl_{(s)} + aq \rightleftharpoons AgCl_{(aq)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$$

$$S_{Ag^+.Cl^-} = [Ag^+]\,[Cl^-]$$

Concentrations are measured in mol dm^{-3}. ↑ IONIC PRODUCT

KB011 pH (*n.*) pH is a method of expressing hydrogen ion concentration. The pH of a solution is the negative logarithm of the hydrogen ion concentration, *e.g.* if the hydrogen ion concentration is 10^{-7}, the $\log_{10}10^{-7}$ is -7, therefore pH is 7. Because the hydrogen ion concentration for water is 10^{-7}, pH 7 is considered neutral. Values below pH 7 are acid, values above pH 7 are alkaline. ↑ IONIC PRODUCT

Reaction Mechanism

KC001 reaction mechanism (*n.*) The way in which a chemical reaction proceeds by a series of steps. ↓ RATE OF REACTION

KC002 electrophilic reagent (*n.*) A reagent which attacks a compound where electrons are in excess, *e.g.* H^+, H_3O^+, NO_2^+ (HNO_3), SO_2OH^+ (H_2SO_4) and NO^+ (HNO_2) ↑ REACTION MECHANISM

KC003 nucleophilic reagent (*n.*) A reagent which attacks a compound in places where electrons are needed, *e.g.* OH^-, $OC_2H_5^-$, Br^-, HSO_3^-, H^- ($LiAlH_4$). ↑ REACTION MECHANISM

KC004 carrier[2] (*n.*) This term is used especially of halogen carriers; it is a substance which can form an intermediate product during reaction or can facilitate the formation of an active reactant during halogenation, *e.g.* the chlorination of benzene is carried out using iron or anhydrous aluminium chloride as the halogen carrier. They facilitate formation of the Cl^+ ion. For oxygen carrier see LEAD CHAMBER PROCESS. ↑ REACTION MECHANISM

KC005 rate of reaction (*n.*) The rate of a chemical reaction is measured either by the rate at which the reactions are used up or the rate at which the products are formed. In the reaction

$$N_2 + 3H_2 \rightarrow 2NH_3$$

the rate can be measured by

$$\frac{-\mathrm{d}[N_2]}{\mathrm{d}t} \quad \text{or} \quad +\frac{1}{2}\frac{\mathrm{d}[NH_3]}{\mathrm{d}t}$$

Rate of reaction is dependent upon certain conditions, viz. concentration of reactants, temperature, a catalyst if present, state of aggregation if one of the reactants is a solid. For a reaction in which one reactant is present a simple rate equation showing dependence on concentration may be written:

$$\frac{\mathrm{d}x}{\mathrm{d}t} = k_1 (a - x)$$

a = initial amount of reactant, x = amount of reactant used up, k_1 = rate constant. If temperature is the variable,

$$\text{rate of reaction} \propto e^{-E/RT}$$

T = temperature in Kelvin and E = activation energy. ↓ RATE CONSTANT

KC006 rate constant (*n.*) In the rate equation $\frac{\mathrm{d}x}{\mathrm{d}t} = k_1 (a - x)$, k_1 is the rate constant. The rate constant for a reaction is unchanged by pressure changes but it changes during catalysis and also with temperature, according to the equation:

$$\frac{\mathrm{d} \ln k}{\mathrm{d}T} = \frac{E}{RT^2}$$

↑ RATE OF REACTION

KC007 rate order (*n.*) The sum of the indices of all the reactants for which the concentrations are found experimentally in the rate equation. In a reaction involving A + B → products, the rate equation may be written:

$$\text{rate} = k(A)^n.(B)^m,$$

when n and m are determined experimentally. The rate order with respect to A is n, with respect to B it is m. The overall rate

Physical Equilibrium

KD001 equilibrium[2] (*n.*) The state of a rigid body when it is at rest because all forces acting on it are in balance. The specific conditions for the equilibrium of a body are: ***a*** the vector sum of the forces is zero; ***b*** the algebraic sum of the moments about any point is zero, *e.g.* ***a*** if equal masses are put in the pans of a beam balance, so that it balances, the beam balance is in equilibrium; ***b*** a ladder leaning against a wall is in equilibrium; ***c*** a wooden box on a floor is in equilibrium □ *in equilibrium —equilibriant* (*n.*) ↓ STABLE EQUILIBRIUM · TRIANGLE OF FORCES · STATICS · STABILIZE[3] · STABLE[2] · RESULTANT FORCE · TURNING FORCE → ELASTICITY

KD002 stable equilibrium (*n.*) A state of equilibrium in which a rigid body is so placed that after being moved by a small impulse, it tends to return to its original position, *e.g.* a motor car is in equilibrium on its four wheels (a sideways push tilts it on two wheels, but it returns to its former position). ↓ UNSTABLE EQUILIBRIUM (An) · NEUTRAL EQUILIBRIUM · STABILITY · INSTABILITY · STABILIZER · STABILIZATION[1]

KD003 unstable equilibrium (*n.*) A state of equilibrium in which a rigid body is so placed that after being moved by a small impulse, it changes its position by moving further away from its original position, *e.g.* a book balanced on its edge is in unstable equilibrium. ↑ STABLE EQUILIBRIUM (An)

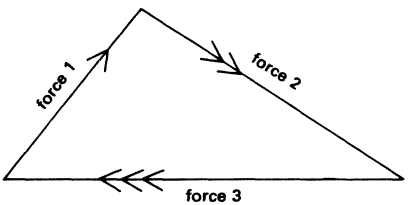
KD004 neutral equilibrium (*n.*) A state of equilibrium in which a rigid body is so placed that after being moved by a small impulse, it comes immediately to rest and remains in that position with no tendency to return to its original position, or to continue to a further position, *e.g.* a ball on a horizontal surface is in neutral equilibrium, as a small force will move it, and it takes up a new position, again in neutral equilibrium. ↑ STABLE EQUILIBRIUM

KD005 stability (*n.*) The property of being stable, *i.e.* in stable equilibrium. ↓ INSTABILITY (An) ↑ STABLE EQUILIBRIUM

KD006 instability (*n.*) The property of being unstable, *i.e.* in unstable equilibrium. ↑ STABLE EQUILIBRIUM · STABILITY (An)

KD007 stabilizer (*n.*) Any structure which stabilizes an object, *e.g.* the fins on a submarine are stabilizers as they stabilize the submarine by keeping it upright. ↑ STABLE EQUILIBRIUM

KD008 stabilization[1] (*n.*) The process of making an object stable. ↑ STABLE EQUILIBRIUM



TRIANGLE OF FORCES

KD009 triangle of forces (*n.*) If three forces acting on a body are concurrent, and they can be represented in magnitude and direction by the sides of a triangle, taken in order, then the three forces are in equilibrium. The expression 'in order' means that the directions of the forces must follow one another round the triangle. ↓ LAMI'S THEOREM · POLYGON OF FORCES · EQUILIBRIANT ↑ EQUILIBRIUM[2]

KD010 Lami's theorem (*n.*) If any three forces are in equilibrium, they must be either parallel or concurrent. If they are concurrent, Lami's theorem states that the magnitude of each force is proportional to the sine of the angle between the other two forces. Stated mathematically:

$$\frac{P}{\sin\theta} = \frac{Q}{\sin\varphi} = \frac{S}{\sin\gamma}$$

where θ is the angle between forces Q and S, and so on. ↑ TRIANGLE OF FORCES

KD011 polygon of forces (*n.*) If four or more forces act at a point, and are in equilibrium, then they can be represented by the sides of a polygon, taken in order. ↑ TRIANGLE OF FORCES

KD012 equilibriant (*n.*) If a body is acted upon by several forces which tend to move it, and a single force can be applied to keep the body at rest, then that single force is an equilibriant, *e.g.* a wooden case is sliding down a plank (forces of gravity and friction are acting on it); a rope is attached to the case and sufficient force applied to prevent the case sliding; the force applied through the rope is the equilibriant. ↑ TRIANGLE OF FORCES

KD013 statics (*n. sing*) The study of forces in equilibrium; it is a branch of mechanics. ↑ EQUILIBRIUM[2]

KD014 stabilize[3] (*v.t.,i.*) **1** (*v.t.*) To make an object stable by making suitable alterations, *e.g.* a heavy weight at the bottom of a sailing boat stabilizes the boat. **2** (*v.i.*) (Of an object) to become stable in this way. —STABILIZER (*n.*) STABILIZATION (*n.*) ↑ EQUILIBRIUM[2]

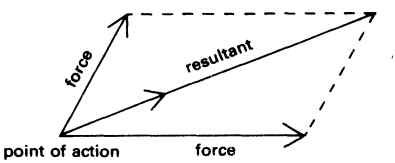
KD015 stable[2] (*adj.*) Tending to return to its original position when a force that has displaced it from its position ceases to act. —STABILITY (*n.*) STABILIZE (*v.*) ↓ UNSTABLE (An) ↑ EQUILIBRIUM[2]

KD016 unstable (*adj.*) Not returning to its original position when a force that has displaced it leaves to act, but moving further away. ↑ STABLE[2] (An)

KD017 resultant force (*n.*) If two or more forces act at a point, it is always possible to replace the forces by a single force which will have exactly the same effect; this single force is a resultant force. ↓ RESULTANT[2] · PLANK · CORD · AEROFOIL · RESOLVE · COPLANAR ↑ EQUILIBRIUM[2]

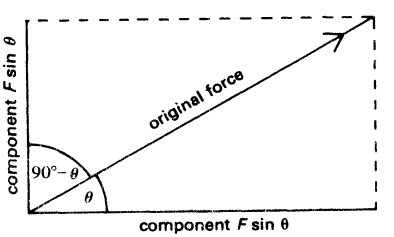
KD018 resultant[2] (*n.*) Alternative term for RESULTANT FORCE. —RESULTANT (*adj.*) ↓ COMPOSITION OF FORCES · PARALLELOGRAM OF FORCES · RESOLUTION OF FORCES · COMPONENT[1] · PARALLEL FORCES · COUPLE[2] ↑ RESULTANT FORCE

KD019 composition of forces (*n.*) The addition of two vector quantities, such as forces, is performed by the parallelogram of forces; when added the two forces form a resultant force—this is to combine forces. ↑ RESULTANT → VECTOR



PARALLELOGRAM OF FORCES

KD020 parallelogram of forces (*n.*) If two forces acting on a body are represented both in magnitude and direction by the adjacent sides of a parallelogram, drawn from a point, then the resultant of the two forces is represented in magnitude and direction by the diagonal of the parallelogram drawn from that point. ↑ RESULTANT[2]



RESOLUTION OF A FORCE

KD021 resolution of forces (*n.*) A single force can be replaced by two forces, called

components, using the reverse process to the composition of forces. The force is made the diagonal of a parallelogram. Such a parallelogram could be drawn in many different ways; the most useful and usual way is when the components are perpendicular. If one component is inclined at an angle θ to the force, then the other component is inclined at $90° - \theta$. If the original force is F, then one component is $F\cos\theta$, and the other is $F\cos(90° - \theta) = F\sin\theta$. ↑ RESULTANT[2]

KD022 component[1] (*n.*) One of the two forces into which a single force can be resolved. ↑ RESULTANT[2]

KD023 parallel forces (*n.pl.*) Parallel forces in the same direction are called **like** parallel forces; such forces can be replaced by a single resultant force. Parallel forces in opposite directions are called **unlike** parallel forces; such forces, with the exception of a couple, can also be replaced by a single resultant force. Two equal unlike parallel forces have no resultant, and are not in equilibrium—they produce an effect of pure rotation; they are called a **couple**. ↑RESULTANT[2]

KD024 couple[2] (*n.*) See PARALLEL FORCES. ↑ RESULTANT[2]

KD025 plank (*n.*) A long, flat, piece of wood, up to 5 cm thick, and 10 cm or more wide. ↓ BOARD · BEAM[1] · GIRDER · STRUT · TIE · CROSS-SECTION ↑ RESULTANT FORCE

KD026 board (*n.*) A piece of wood of the same shape as a plank, but thinner and narrower than a plank. ↑ PLANK

KD027 beam[1] (*n.*) A long piece of wood, square or rectangular in cross-section, used in buildings, and generally supported at both ends; instead of wood, a beam can be made of steel, or of light alloy, or of concrete. ↑ PLANK

KD028 girder (*n.*) An iron or steel beam, usually with an H- or T- or U-shaped cross-section, used in buildings; also a compound structure of ties, struts and beams, used to build bridges or roofs. ↑ PLANK

KD029 strut (*n.*) A rod, or bar, connecting two parts of a structure; in keeping the two parts together, it is under thrust. ↑ PLANK → THRUST

KD030 tie (*n.*) A rod, or bar, connecting two parts of a structure; in keeping the two parts together it is under tension. ↑ PLANK → TENSION

KD031 cross-section (*n.*) **1** The shape of the end of a body which is seen when the body is cut in a line perpendicular to the long axis of the body, *e.g.* ***a*** the cross-section of a cylinder is a circle; ***b*** the cross-section of a tube is a ring; ***c*** the cross-section of a door is a long thin rectangle. **2** A thin piece cut from a body by making two parallel cuts perpendicular to the long axis. ↑ PLANK

KD032 cord (*n.*) A cord is thicker and stronger than string, but less thick and usually less strong than a rope, *i.e.* it is halfway between string and rope in size and strength. ↓ CABLE[1] ↑ RESULTANT FORCE

KD033 cable[1] (*n.*) A very thick rope, or a number of wires twisted together to form a single wire cable. A cable is used to pull a ship, a vehicle, or a lift; it can withstand heavy loads without breaking. ↑ CORD

KD034 aerofoil (*n.*) Any flat or curved surface which makes use of aerodynamic forces, *e.g.* ***a*** the curved wing of an aeroplane creates an upward thrust as it travels through the air; ***b*** the rudder of an aeroplane creates a sideways thrust when turned, and so guides the aeroplane. See also **EC086.** ↓ LIFT[1] · ELEVATOR[2] · LIFT[2] · ELEVATOR[3] ↑ RESULTANT FORCE → AERODYNAMICS

KD035 lift[1] (*n.*) A force which makes a body, or any object, rise in the air, *e.g.* the aerodynamic force which raises, or supports, an aeroplane in flight. —***lift*** (*v.*) ↑ AEROFOIL

KD036 elevator[2] (*n.*) A flat surface which makes use of aerodynamic force to increase or decrease the height of an aeroplane. ↑ AEROFOIL

KD037 lift[2] (*n.*) A box-like machine which carries people up and down from one floor to another in a tall building. Also called an ***elevator.*** ↑ AEROFOIL

KD038 elevator[3] (*n.*) (2) Alternative term for a LIFT[2]. ↑ AEROFOIL

KD039 resolve (*v.t.*) To carry out a resolution of a force, *i.e.* a force is resolved into two components which produce the same effect as the original force. ↓ TOW ↑ RESULTANT FORCE · RESOLUTION OF FORCES

KD040 tow (*v.t.*) To pull a boat by means of a rope or a cable and to keep the boat in motion; also (of a vehicle) to pull another vehicle and to keep it in motion, *e.g.* a lorry tows a motor car which has broken down. ↑ RESOLVE

KD041 coplanar (*adj.*) Describes forces, or vectors, or lines, which lie in one plane. ↓ CONCURRENT · LIKE[1] · UNLIKE[1] · EFFECTIVE ↑ RESULTANT FORCE

KD042 concurrent (*adj.*) Describes forces, or vectors, or lines, that meet in one point. ↑ COPLANAR

KD043 like[1] (*adj.*) (Of parallel forces) acting in the same direction. ↓ UNLIKE[1] (An) ↑ COPLANAR

KD044 unlike[1] (*adj.*) (Of parallel forces) acting in opposite directions. ↑ COPLANAR · LIKE[1] (An)

KD045 effective (*adj.*) (Of a component force) acting in a required direction, *e.g.* the force on the wing of an aeroplane can be resolved into a lift and a drag; the lift is the effective force, as it is the effort required; drag is not required and is a loss of energy. ↑ COPLANAR

KD046 turning force (*n.*) A force that causes rotation of a body about an axis. ↓ MOMENT OF A FORCE · TORQUE · TORSION BALANCE · CLOCKWISE ↑ EQUILIBRIUM[2]

KD047 moment of a force (*n.*) The moment is the turning effect of a force when applied to a body; it is measured by multiplying the magnitude of the force by the perpendicular

distance between the direction of the force and the axis about which the body rotates. ↓ PRINCIPLE OF MOMENTS · MOMENT OF A COUPLE ↑ TURNING FORCE

KD048 principle of moments (*n.*) If a body is in equilibrium under the action of forces, the sum of the clockwise moments (*i.e.* moments of the forces tending to turn the body in a clockwise direction) is equal to the sum of the anticlockwise moments about any point in the body. ↑ MOMENT OF A FORCE

KD049 moment of a couple (*n.*) The moment calculated from the magnitude of one of the forces multiplied by the perpendicular distance between them. ↑ MOMENT OF A FORCE → COUPLE[2]

KD050 torque (*n.*) A turning force, a moment of a force, or a couple, which produces, or tends to produce, rotation. ↓ TORSION ↑ TURNING FORCE

KD051 torsion (*n.*) **1** A process of twisting a body by turning one end and keeping the other end stationary, or by turning both ends in opposite directions. The body is twisted about an axis. A torsion is produced by applying a torque at one end, or torques in opposite directions at both ends. The torque can be a single force or a couple. **2** The strain produced in a body by a torque □ *under torsion; the torsion in a wire is produced by a couple* —***torsional*** (*adj.*) ↑ TORQUE

KD052 torsion balance (*n.*) An instrument for the accurate measurement of small forces; it consists of a thin wire with a small rod attached at a right angle to the bottom of the wire; the top of the wire is attached to a torsion head. A small mirror is mounted on the rod, and the reflection of a ray of light measures the angle through which the rod is twisted. The wire is acted upon by a couple applied to the rod, the axis of the couple coinciding with the axis of the wire. The angle through which the wire is twisted depends upon the moment of the couple and the modulus of rigidity of the wire. The angle through which the wire is twisted can be used to measure a force. ↓ TORSION HEAD ↑ TURNING FORCE → MODULUS OF RIGIDITY

KD053 torsion head (*n.*) A large knob, with a graduated scale, in a torsion balance. By turning the torsion head, the wire of a torsion balance is put under torsion. ↑ TORSION BALANCE

KD054 clockwise (*adj.*) Describes a turning movement, a rotation, or a revolution, that goes in a circular direction which is the same as the direction of movement of the hands of a clock. ↓ ANTICLOCKWISE (Cn) ↑ TURNING FORCE

KD055 anticlockwise (*adj.*) Describes a turning movement opposite in direction to a clockwise movement. ↑ CLOCKWISE (Cn)

Elasticity

KE001 elasticity (*n.*) The property of a material, or substance, or a body made of such material or substance, of returning to its original size and shape after distortion by a force. —ELASTIC (*adj.*) ↓ STRESS · HOOKE'S LAW · MODULUS OF ELASTICITY · RESTITUTION · PLASTICITY[1] · STRETCH → EQUILIBRIUM[2]

KE002 stress (*n.*) A force per unit area, measured in newtons per metre squared ($N\ m^{-2}$). Examples of a stress include a tension, a thrust, and a shearing force □ *a stretched material is under stress; to apply a stress* ↓ STRAIN · SHEAR · ANGLE OF SHEAR ↑ ELASTICITY

KE003 strain (*n.*) When a stress is applied to a body a strain is produced. The body can be distorted or deformed, depending upon its elasticity. Strain is measured by the ratio of the dimensional change produced to the original dimension. It may be a ratio of lengths, areas, or volumes, *e.g.* the ratio of the change in length to the original length. ↑ STRESS

KE004 shear (*n.*) **1** A stress applied to a body along one face only of the body. This is a shearing stress. **2** The strain produced by a shearing stress, *e.g.* *a* a metal cube with a shearing stress on its upper surface becomes distorted so that the square face perpendicular to the stress, and on the side of the cube, becomes a rhombus; ***b*** if the shearing force is a torque applied to a wire or rod, the wire or rod is twisted. These are changes of shape, but not of size. —***shearing*** (*adj.*) ↑ STRESS

KE005 angle of shear (*n.*) (For small shearing distortions) the angular distortion of a face perpendicular to the shearing stress, *e.g.* when a square is distorted to a rhombus, it is the angle by which the side of the square has turned to become the rhombus. The symbol is θ (the Greek letter theta). ↑ STRESS

KE006 Hooke's law (*n.*) The extension of an elastic material is proportional to the force stretching it, provided the force is below the elastic limit. ↓ ELASTIC LIMIT · LIMIT OF PROPORTIONALITY · PERMANENT SET · YIELD POINT · BREAKING STRESS · POISSON'S RATIO ↑ ELASTICITY

KE007 elastic limit (*n.*) The limit of force below which a wire or rod returns to its original length after having been stretched by a force. ↑ HOOKE'S LAW

KE008 limit of proportionality (*n.*) The limit of force on a body above which Hooke's law no longer applies. The limit of proportionality and the elastic limit coincide approximately, but not necessarily. ↑ HOOKE'S LAW

KE009 permanent set (*n.*) The amount of permanent deformation produced in an elastic body, or elastic material, when the applied force has exceeded the elastic limit. ↑ HOOKE'S LAW

KE010 yield point (*n.*) After the elastic limit is passed, the deformation of a wire, or rod, increases much more rapidly with increasing force than previously; the point at which this stage begins is the yield point. ↑ HOOKE'S LAW

KE011 breaking stress (*n.*) The stress on a wire, or rod, which causes it to break; this stage is reached soon after the yield point. ↑ HOOKE'S LAW

KE012 Poisson's ratio (*n.*) In a stretched wire, the ratio of

$$\frac{\text{contraction sideways}}{\text{extension lengthways}}$$

It is the ratio of

$$\frac{\text{lateral strain}}{\text{longitudinal strain}} = \frac{d/D}{x/l} = \frac{dl}{xD}$$

where d is the change in diameter from the original diameter D, x is extension, and l is length. ↑ HOOKE'S LAW

KE013 modulus of elasticity (*n.*) The ratio of $\frac{\text{stress}}{\text{strain}}$ for an elastic material. ↓ YOUNG'S MODULUS · BULK MODULUS · MODULUS OF RIGIDITY · SHEAR MODULUS ↑ ELASTICITY

KE014 Young's modulus (*n.*) The modulus of elasticity of a wire or rod stretched longitudinally, or of a rod compressed longitudinally.

$$\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{F}{A}$$

$$\text{Strain} = \frac{\text{Extension}}{\text{Length}} = \frac{x}{l}$$

$$\text{Young's modulus} = E = \frac{\text{stress}}{\text{strain}} = \frac{Fl}{Ax}$$

It is measured in $N\,m^{-2}$. ↑ MODULUS OF ELASTICITY

KE015 bulk modulus (*n.*) The modulus of elasticity for a body having a stress applied over the whole of its surface.

$$\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{F}{A}$$

$$\text{Strain} = \frac{\text{change in volume}}{\text{original volume}} = \frac{v}{V}$$

$$\text{Bulk modulus} = K = \frac{\text{stress}}{\text{strain}} = \frac{FV}{Av}$$

↑ MODULUS OF ELASTICITY

KE016 modulus of rigidity (*n.*) The modulus of elasticity for a body under a shearing stress. It is equal to the shearing stress divided by the angle of shear.

$$\text{Modulus of rigidity } (G) = \frac{\text{stress}}{\text{strain}} = \frac{F}{A\theta}$$

↑ MODULUS OF ELASTICITY

KE017 shear modulus (*n.*) Alternative term for MODULUS OF RIGIDITY (↑).

KE018 restitution (*n.*) The process in which a body returns to its former position or its former shape, *e.g.* when an elastic ball is dropped onto a hard surface, the ball rebounds back towards its former position; this is restitution. It is caused by the elastic energy stored in the material of the ball, providing the impulse. ↓ ELASTIC ENERGY · COEFFICIENT OF RESTITUTION ↑ ELASTICITY

KE019 elastic energy (*n.*) The potential energy stored in a strained elastic body. For a spring:
elastic energy = average force × extension
It is equal to the area under a curve of force against extension. Elastic energy causes elastic bodies to rebound. ↑ RESTITUTION

KE020 coefficient of restitution (*n.*) If a sphere of a given material rebounds from a surface of another material, the coefficient of restitution (e) determines the height of the rebound. If the original height, from which the sphere is dropped is h_1, and the height of the rebound is h_2, then:

$$e = \sqrt{\frac{h_2}{h_1}}$$

The rebound is always less than the original height, and e is always less than unity. Values of e are given naming the material of the sphere and the surface, *e.g.* glass/ivory, glass/glass, etc. ↑ RESTITUTION

KE021 plasticity[1] (*n.*) The property of a material, or substance, of being permanently deformed by a force, without breaking. —PLASTIC (*adj.*) ↓ ELASTIC FATIGUE ↑ ELASTICITY

KE022 elastic fatigue (*n.*) Certain materials after removal of a stress do not immediately regain their original shape and size, but only return slowly to their original state. This phenomenon is called elastic fatigue. ↑ PLASTICITY[1]

KE023 stretch (*v.t.*) To increase the length of a body by a force, *e.g.* a weight stretches a spring. ↓ REBOUND · SNAP[2] ↑ ELASTICITY

KE024 rebound (*v.i.*) When an elastic body falls onto a fixed, rigid surface, the body is returned upwards along its path of falling; this is rebounding, *e.g.* a ball dropped on a floor rebounds upwards. —REBOUND (*n.*) ↑ STRETCH

KE025 snap[2] (*v.t.,i.*) **1** (*v.i.*) (Of a rigid body) to break suddenly under a force, usually accompanied by a sharp noise. **2** (*v.t.*) To break a rigid body suddenly by applying a force. ↑ STRETCH

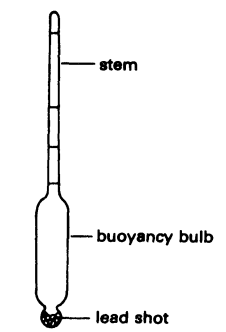
Hydrostatics

KF001 hydrostatics (*n. sing*) The study of fluids at rest. ↓ DENSITY[1] · PRESSURE · ARCHIMEDES' PRINCIPLE · LIQUID COLUMNS · PRESSURE GAUGE

KF002 density[1] (*n.*) The mass per unit volume, or the mass divided by the volume, of a given piece of matter. The units are kilograms per cubic metre (kg m^{-3}), *e.g.* the density of mercury is 13.6×10^3 kg m^{-3} □ *high density; low density* —DENSE[2] (*adj.*) ↓ RELATIVE DENSITY[1] · MAXIMUM DENSITY OF WATER · HYDROMETER ↑ HYDROSTATICS

KF003 relative density[1] (*n.*) Relative density is the density of a given material divided by the density of water. The relative density of mercury is 13·6. For a gas the relative density is usually given with respect to hydrogen. ↑ DENSITY[1] → VAPOUR DENSITY

KF004 maximum density of water (*n.*) The density of water is a maximum at 4°C (277 K). Above this temperature the density falls with increasing temperature and below 4°C the density falls until the water freezes at 0°C (273 K). ↑ DENSITY[1]



HYDROMETER

KF005 hydrometer (*n.*) A device for measuring the relative density of a liquid. It consists of a bulb of large volume to give it buoyancy with lead shot in the bottom. Above the bulb is a narrow graduated stem which has been calibrated to read densities. The hydrometer depends upon the principle of flotation. To find the relative density of a liquid the hydrometer is floated in it and the value for the relative density read off. As the range on a given stem is limited, a set of hydrometers is used to cover a wide range. ~~*hydrometry* (*n.*)~~ ↑ DENSITY[1]

KF006 pressure (*n.*) Force per unit area, or the force acting on a surface divided by the area over which it acts. If a force of 100 N acts on a surface of 2 m^2 then the pressure is 50 N m^{-2} or 50 Pa (pascal) □ *high pressure; low pressure* —*press* (*v.*) ↓ LIQUID PRESSURE · PRESSURE AT A POINT · TRANSMISSION OF PRESSURE · ATMOSPHERIC PRESSURE · BERNOUILLI EFFECT · VACUUM · SUCTION

KF007 liquid pressure (*n.*) The pressure at a point in a liquid is the force per unit area on a very small area round the point. This may

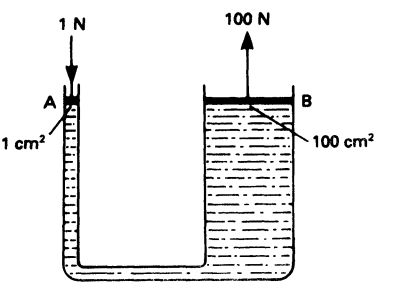
$$p = \frac{F}{A}$$

If the point is at a depth h in the liquid, density ρ, then $p = h\rho g$. The pressure at a point in a liquid at rest acts equally in all directions. The force exerted on a surface in contact with a liquid at rest is perpendicular to the surface at all points. ↑ PRESSURE

KF008 pressure at a point (*n.*) The pressure on an infinitesimal area represented by:

$$p = \lim_{A \to 0} \frac{E}{A}$$

For a liquid, the pressure acts equally in all directions. ↑ PRESSURE



pressure in liquid 1×10^{-4}Pa (1 N cm^{-2})

TRANSMISSION OF PRESSURE IN A LIQUID

KF009 transmission of pressure (*n.*) A pressure applied to a liquid is transmitted equally to all its parts. Various hydraulic devices make use of this principle, as in hydraulic braking systems, the hydraulic press, and the hydraulic jack. ↑ PRESSURE

KF010 atmospheric pressure (*n.*) The pressure exerted by the atmosphere at various places on the earth's surface; it is caused by a column of air reaching from the

earth's surface up to a distance of about 85 km. ↑ PRESSURE

KF011 Bernouilli effect (*n.*) The effect where in a tube with a constriction the pressure is lowered in the liquid passing through the narrow part of the tube, but rises again in the wider section. ↑ PRESSURE

KF012 vacuum (*n.*) A space in which there is no matter. This cannot in effect be achieved since a few atoms of some substance must be present □ *partial vacuum* —EVACUATE (*v.*) ***evacuated*** (*adj.*) ↑ PRESSURE

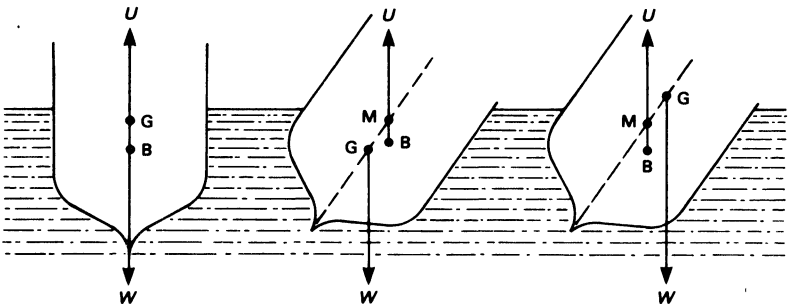
KF013 suction (*n.*) Drawing up liquid by forming a partial vacuum above the liquid. The liquid rises because there is pressure on its main surface; the partial vacuum is often in the mouth. ↑ PRESSURE

KF014 in vacuo (*adv.*) The condition in which some processes may take place or be carried out in a vacuum. The process may be carried out because the substance may react with the oxygen of the air, or because the substance decomposes if distilled in air, *e.g.* distilled in vacuo to avoid decomposition. ↑ PRESSURE

KF015 Archimedes' principle (*n.*) When a body is wholely or partly immersed in a fluid there is an upthrust on the body which is equal to the weight of water displaced. The body accordingly appears to lose weight. ↓ UPTHRUST · PRINCIPLE OF FLOTATION · BUOYANCY · CENTRE OF BUOYANCY · METACENTRE ↑ HYDROSTATICS

KF016 upthrust (*n.*) An upward force. —***thrust up*** (*v.*) ↑ ARCHIMEDES' PRINCIPLE

KF017 principle of flotation (*n.*) The principle that a floating body displaces its own weight of fluid; a special case of Archimedes' principle. ↑ ARCHIMEDES' PRINCIPLE



BUOYANCY

KF018 buoyancy (*n.*) **1** The ability to float or keep something afloat, *e.g.* ***a*** the buoyancy of a hot air balloon; ***b*** the buoyancy of the air keeps up a hydrogen balloon. **2** The loss of weight shown by a body when immersed in a fluid. ↑ ARCHIMEDES' PRINCIPLE

KF019 centre of buoyancy (*n.*) The centre of gravity of the displaced water for a floating body. ↑ ARCHIMEDES' PRINCIPLE

KF020 metacentre (*n.*) The point of intersection of the vertical line from the centre of buoyancy and the central line of the floating body when displaced from its equilibrium position. If the metacentre is above the centre of gravity, the floating body will be in stable equilibrium. If the metacentre is below the centre of gravity, equilibrium will be unstable. ↑ ARCHIMEDES' PRINCIPLE

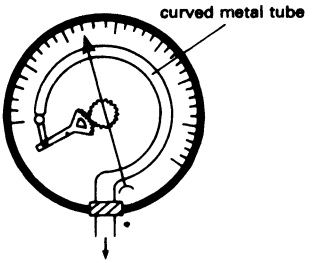
KF021 liquid columns (*n.pl.*) Columns of liquid in different types of tube. The pressure in a column of liquid is directly proportional to the height of the column. Tubes can be devised so that columns of liquid are balanced by other columns of liquid, as in a U-tube, or by the atmosphere, as in a barometer. ↓ MANOMETER ↑ HYDROSTATICS

KF022 balancing liquid columns (*n.pl.*) Liquid columns which are in equilibrium because the pressure on the surface of the two liquids is that of atmospheric pressure. At a given level the pressure may be measured as 1 atm + $h_1\rho_1$, and for the other liquid as 1 atm + $h_2\rho_2$. The given level will be an interface for the two immiscible liquids in one of the columns or, for miscible liquids, the level of mercury (or other liquid not miscible with either of the liquids) balanced by the two liquids. The cross-section of the tubes does not affect the balance of the liquids. ↑ LIQUID COLUMNS

KF023 manometer (*n.*) An open U-tube which contains a suitable liquid. It can be used for measuring gas pressures by attaching a tube to one arm. Some manometers may have one arm closed and filled with

nitrogen. Liquid mercury is usually used as the balance liquid. ↑ LIQUID COLUMNS

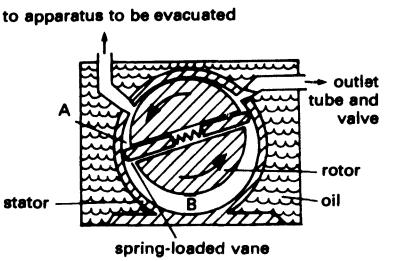
KF024 pressure gauge (*n.*) An instrument for measuring pressure; it may be of the simple manometer type, or a more elaborate instrument, such as the Bourdon or McLeod gauge. ↓BOURDON GAUGE · MCLEOD GAUGE · VACUUM PUMP · BAROMETER · MERCURY BAROMETER · FORTIN BAROMETER · ANEROID BAROMETER · SIPHON[1] ↑ HYDROSTATICS



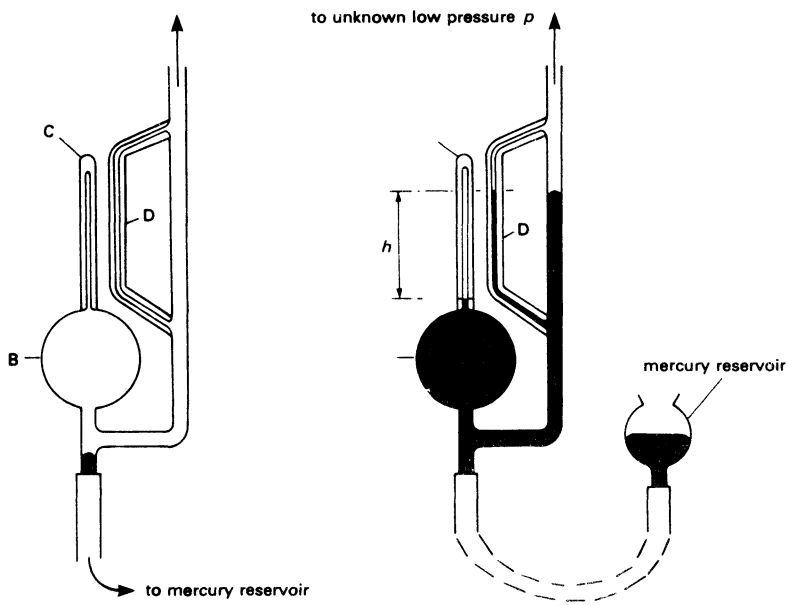
BOURDON GAUGE

KF025 Bourdon gauge (*n.*) This gauge is most suitable for measuring high pressure, such as 2000 atmospheres. It consists of a flat tube bent into a circle. Increase in pressure causes the tube to straighten out. As it straightens out its movement is magnified by a suitable device. ↑PRESSURE GAUGE

KF026 McLeod gauge (*n.*) This gauge is designed for measuring low pressures. It is based on Boyle's Law. The volume B and C are connected to an unknown vessel at low pressure. When the mercury rises the gas in B is compressed into the tube C where its pressure can be measured. If V is the volume of B and C, and V_1 is the volume of gas above the mercury after compression, then $pV = (p + h)V_1$, if p is the unknown pressure. The tube D has the same bore as C, so eliminating error from capillarity. ↑ PRESSURE GAUGE



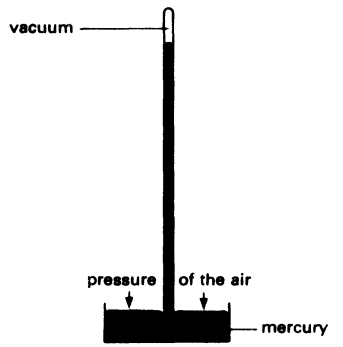
VACUUM PUMP (see **KF027**)



MCLEOD GAUGE

KF027 vacuum pump (*n.*) A device for reducing the pressure of a gas in a vessel by removing the gas. Efficient pumps can reduce the pressure of the gas to between 100 and 0·1 pascal. ↑ PRESSURE GAUGE

KF028 barometer (*n.*) An instrument for measuring the pressure of the atmosphere. There are two types: the mercury barometer and the aneroid barometer. —***barometric*** (*v.*) ↑ PRESSURE GAUGE · ATMOSPHERIC PRESSURE



MERCURY BAROMETER

KF029 mercury barometer (*n.*) A barometer in which the pressure of the atmosphere is balanced against a column of mercury. ↑ PRESSURE GAUGE

KF030 Fortin barometer (*n.*) A mercury barometer adapted for direct reading. ↑ PRESSURE GAUGE

KF031 aneroid barometer (*n.*) A barometer which depends upon the changing volume of a partially evacuated thin metal box. The face of the box is corrugated for strength. The movement of the face in and out with changing external pressure is magnified by a suitable lever system and converted to a rotation to move an indicator needle. ↑ PRESSURE GAUGE

KF032 siphon[1] (*n.*) A device which uses atmospheric pressure to force a liquid through a tube to a lower level. Typically it consists of a tube bent to form two legs of unequal length; the liquid is transferred to a lower level over an intermediate elevation by the pressure of the atmosphere in forcing the liquid up the shorter branch of the tube immersed in it, while the excess of weight of the liquid in the longer branch, when once filled, causes a continuous flow. ↑ PRESSURE GAUGE

KF033 compress (*v.t.*) To exert pressure upon an object, usually a gas, to reduce its volume. ↑ PRESSURE GAUGE

KF034 buoyant (*adj.*) Having the disposition to float. ↑ PRESSURE GAUGE

Measurement, SI Units

KG001 clock (*n.*) Any device for measuring intervals of time. A **stop-clock** is one that can be started and stopped to measure the interval of time between two events. ↓ CHRONOMETER · PULSE[3] · SYNCHRONIZER · SYNCHRONIZE · SYNCHRONOUS · SI UNITS

KG002 chronometer (*n.*) A clock which measures intervals of time very accurately. The term is mainly applied to instruments used in navigation. ↓ ATOMIC CLOCK ↑ CLOCK

KG003 atomic clock (*n.*) An apparatus for measuring time very accurately, using changes in energy of atoms or molecules. Caesium atoms or ammonia molecules can absorb radio waves in the microwave region and the atom or molecule then changes its energy level. Only microwaves of a particular frequency are absorbed. The absorption of such a frequency is used to stabilize an oscillating electric circuit. The frequency of oscillation of the circuit is then known accurately and can be used to drive the mechanism of an atomic clock. The caesium clock is used in defining the second. ↑ CHRONOMETER

KG004 stop watch (*n.*) A watch that can be started and stopped by a knob so that the duration of short periods of time can be measured accurately. Stop watches usually measure accurately to 0·2 s ↑ CHRONOMETER

KG005 pulse[3] (*n.*) A brief increase in the magnitude of a quantity which otherwise is constant with time. —PULSATING[2] (*adj.*) ↓ CHRONON ↑ CLOCK

KG006 chronon (*n.*) A hypothetical unit, consistent with the smallest discrete interval of time. It is the time taken for light to traverse a distance in a vacuum equal to the diameter of an electron. It is approximately equal to 10^{-24} second. ↑ PULSE[3]

KG007 synchronizer (*n.*) A device for keeping two or more mechanisms in synchronous operation, *e.g.* a synchronizer is driven by a master clock; the synchronizer in turn drives a number of clocks and ensures they all record exactly the same time of day. —SYNCHRONIZE (*v.*) SYNCHRONOUS (*adj.*) SYNCHRONIZED (*adj.*) ↓ STROBOSCOPE ↑ CLOCK

KG008 stroboscope (*n.*) An instrument which periodically illuminates a moving object with a quick flash of light emitted at regular intervals, or an instrument which allows a rotating or vibrating object to be observed through holes in a rotating disc

This has the effect of making the object visible at regular intervals. If the object is in motion in a straight line, it will be observed at regular intervals of space if travelling at a uniform velocity. For a rotating object, the object will appear at rest if the periodicity of the illumination is synchronous with the period of rotation. The instrument is used to determine rates of rotation or rates of revolution. —***stroboscopic*** (*adj.*) ↑ SYNCHRONIZER

KG009 synchronize (*v.t.*) To make two events, processes, or operations, synchronous, *e.g.* ***a*** to adjust one clock so that it records exactly the same time of day as another clock; ***b*** to illuminate a periodic motion with intermittent light so that the light and the motion are in phase. —SYNCHRONIZATION, SYNCHRONIZER (*n.*) SYNCHRONOUS (*adj.*) ↓ TIME[2] ↑ CLOCK

KG010 time[2] (*v.t.*) To measure a time interval between two events, *e.g.* to time 20 swings of a pendulum is to measure the time interval of 20 swings of the pendulum. ↑ SYNCHRONIZE

KG011 synchronous (*adj.*) Describes processes, events or operations, that take place at the same time, or change in identical ways at the same time. Synchronous processes possess an identical rhythm and are in phase, *e.g.* ***a*** two clocks which record the same time of day are synchronous; ***b*** two pendulums with identical periods, swinging in phase, are synchronous; ***c*** a synchronous electric motor uses a.c. and its rate of rotation is such that the number of times a pole of the armature passes the pole of an electromagnet is a multiple of the frequency of the a.c. —SYNCHRONIZE (*v.*) SYNCHRONIZER (*n.*) SYNCHRONIZED (*adj.*) ↓ SYNCHRONIZED · PULSATING[2] ↑ CLOCK

KG012 synchronized (*adj.*) Describes a mechanism which has been made synchronous with another mechanism, or describes two synchronized mechanisms □ *synchronized with* ↑ SYNCHRONOUS

KG013 pulsating[2] (*adj.*) Describes a quantity which has regular pulses of equal magnitude, *e.g.* a pulsating current is one which has pulses of identical magnitude at regular intervals, with the magnitude of the pulse always in the same directions. A half-wave rectified current is pulsating. —PULSE[3] (*n.*) ↑ SYNCHRONOUS

KG014 SI units (*n.pl.*) An internationally agreed system of coherent units, based on seven basic units: the metre (m); the kilogramme (kg); the second (s); the kelvin (K); the ampere (A); the candela (cd); the mole (mol). The radian (rad) and steradian (sr) are supplementary measurements of angles. All other units are derived from these. When stating a physical quantity there is no need to mention units as they are automatically known from the system, *e.g.* when stating an electric current, it must be measured in amperes, so there is no need to mention the unit in an equation or formula. SI stands for Système International. ↓ METRE · NEWTON · VOLT · WEBER · HERTZ · DERIVED UNITS ↑ CLOCK

KG015 metre (*n.*) The length equal to 1 650 763·73 wavelengths *in vacuo* of the radiation corresponding to the transition between the levels $2p_{10}$ and $5d_5$ of the krypton-86 atom. The symbol is m. ↓ KILOGRAM · SECOND · KELVIN · AMPERE · CANDELA · MOLE[1] · RADIAN · STERADIAN ↑ SI UNITS

KG016 kilogramme (*n.*) A mass defined by an international prototype kept at Sèvres, in France. The symbol is kg. ↑ METRE

KG017 second (*n.*) The duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium-133 atom. The symbol is s. ↑ METRE

KG018 kelvin (*n.*) The fraction $^1/_{273\cdot16}$ of the thermodynamic temperature of the triple point of water. The symbol is K. ↑ METRE

KG019 ampere (*n.*) A current of one ampere is that constant current which, flowing in two infinitely long, straight, parallel conductors, of negligible circular cross-section, placed 1 metre apart in a vacuum, would produce a force between them of 2×10^{-7} newton per metre length of conductor. This is the basic SI unit in electricity; all other units are derived through it. The symbol is A. ↑ METRE

KG020 candela (*n.*) The luminous intensity, in the perpendicular direction, of a surface of $^1/_{600\,000}$ square metre of a black body at the temperature of freezing platinum under a pressure of 101 325 newtons per square metre. The symbol is cd. ↑ METRE

KG021 mole[1] (*n.*) The amount of substance which contains as many elementary units as there are atoms in 0·012 kilogramme of carbon-12. The elementary unit must be specified and may be an atom, a molecule, an ion, a radical, an electron, a photon, etc., or a specified group of such entities. The symbol is mol. ↑ METRE

KG022 radian (*n.*) The unit of measurement of a plane angle. It is the angle subtended at the centre of a circle by an arc equal in length to the radius of the circle. π radians = 180°, 1 radian = 57·296°. The symbol is rad. ↑ METRE

KG023 steradian (*n.*) The unit of measurement of a solid angle. It is the solid angle produced at the centre of a square by an area on the surface of the sphere equal to the square of the radius. The symbol for a solid angle is Ω or ω (the Greek letters capital and small omega). The solid angle subtended by a surface of area at the centre of a sphere of radius r is A/r^2. If A is the whole surface of the sphere ($A = 4\pi r^2$) the total solid angle at the centre of the sphere is $4\pi r^2/r^2$, or 4π steradians. The symbol is sr. ↑ METRE

KG024 newton (*n.*) The unit of force; the force required to give a mass of one kilogramme an acceleration of one metre per second per second. The symbol is N. ↓ JOULE · WATT · PASCAL ↑ SI UNITS

KG025 joule (*n.*) The unit of energy and work; it is the work done when the point of application of a force of one newton is displaced through a distance of one metre in the direction of the force. It is also the work done when a current of 1 ampere flows through a resistance of 1 ohm for 1 second. The symbol is J. ↑ NEWTON

KG026 watt (*n.*) A unit of power; the power equal to 1 joule per second ($J\ s^{-1}$). The symbol is W. ↑ NEWTON

KG027 pascal (*n.*) The unit of pressure; a pressure equal to 1 newton per square metre. The symbol is Pa. ↑ NEWTON

KG028 volt (*n.*) The volt is the potential difference between two points such that the energy transformed from electrical to other forms is 1 joule per coulomb of electric charge passing from one point to the other. The symbol for volts is V, and for potential difference is V.

$$V = \frac{\text{energy}}{Q}$$

i.e. energy $= QV$

Both potential difference and electromotive force are measured in volts, as both are defined in terms of energy transformed per unit charge. The symbol for electromotive force is E,

i.e. energy $= QE$

—VOLTAGE (*n.*) ↓ COULOMB · OHM · RECIPROCAL OHM · SIEMENS · FARAD ↑ SI UNITS → VOLTAGE

KG029 coulomb (*n.*) The quantity of electric charge that passes a given point in a circuit when a current of 1 ampere flows for 1 second. The symbol is C. The relation between the coulomb and the ampere is:

coulombs = amperes × seconds

$$Q = It$$

↑ VOLT

KG030 ohm (*n.*) The ohm is the resistance of a conductor through which a steady current of 1 ampere passes when a potential difference of 1 volt exists across it, the conductor itself not being the site of an electromotive force. The symbol is Ω (the Greek letter omega). ↑ VOLT

KG031 reciprocal ohm (*n.*) The unit of measurement of conductance. If a resistor has a resistance of 4 ohms, its conductance is ¼ ohm^{-1}, *i.e.* 0·25 reciprocal ohms, written as 0·25 ohm^{-1}, or 0·25 Ω^{-1}. ↑ VOLT

KG032 siemens (*n.*) A unit of electrical conductance equivalent to one reciprocal ohm. The symbol is S. ↑ VOLT

KG033 farad (*n.*) The unit of capacitance; the capacitance of a capacitor on each plate of which there is a charge of 1 coulomb when a p.d. of 1 volt exists across it. The symbol is F. ↑ VOLT

KG034 weber (*n.*) The unit of magnetic flux. If the magnetic flux linking a single turn coil is 1 weber, an e.m.f. of 1 volt will be induced in the coil when the flux linkage is reduced to zero at a uniform rate in 1 second. The symbol is Wb. ↓ TESLA · HENRY ↑ SI UNITS

KG035 tesla (*n.*) The unit of magnetic flux density. The flux density of a magnetic field is 1 tesla if it has one weber of magnetic flux per square metre. The symbol is T. ↑ WEBER

KG036 henry (*n.*) The unit of inductance. A conductor has a self-inductance of 1 henry if an e.m.f. of 1 volt is induced in it when the current in it changes at the rate of 1 ampere in 1 second. The symbol is H. ↑ WEBER

KG037 hertz (*n.*) A unit of frequency; the frequency of a periodic phenomenon of which the periodic time is one second. It replaces the older unit of 1 cycle per second. The symbol is Hz. ↓ RÖNTGEN · REM · RAD · ROENTGEN · $LUMEN^2$ · LUX ↑ SI UNITS

KG038 röntgen (*n.*) The röntgen (symbol R) is the quantity of X-rays or gamma radiation that liberates by ionization $8{\cdot}38 \times 10^{-3}$ joules of energy per kilogramme of dry air at s.t.p. The total dose received by a person should not exceed 50 mR per year; the rate at any given time should not exceed 0·25 mR per hour. Destruction of animal tissues requires a total dose of several thousand röntgen. The use of the röntgen as a unit is becoming less frequent; it is equal to $2{\cdot}58 \times 10^{-4}$ C kg. ↑ HERTZ

KG039 rem (*abbr.*) Abbreviation for röntgen equivalent man. One rem is the equivalent dose of ionizing radiation which gives the same biological effect as one röntgen of X-rays. ↑ HERTZ

KG040 rad (*n.*) The unit of absorbed dose of radiation. One rad is equal to the energy absorption of 10^{-2} joules per kilogramme of irradiated material. ↑ HERTZ

KG041 roentgen (*n.*) Alternative term for RÖNTGEN. ↑ HERTZ

KG042 $lumen^2$ (*n.*) The unit of luminous flux; the amount of light emitted per second in unit solid angle of one steradian by a uniform point source of intensity one candela. The symbol is lm. ↑ HERTZ

KG043 lux (*n.*) The unit of illumination; one lumen per square metre. The symbol is lx. ↑ HERTZ

KG044 derived units (*n.pl.*) Units on the SI system which are obtained by a combination of the fundamental or basic units of the system, *e.g.* ***a*** the newton is derived from the units of mass (the kilogramme), length (the metre) and time (the second); ***b*** the pascal is derived from the newton and the square metre. ↑ SI UNITS

Thermal Expansion, Temperature

LA001 temperature (*n.*) A property of an object that indicates in which direction heat energy will flow if the object is placed in thermal contact with another object. Heat energy flows from places of higher temperature to places of lower temperature. ↓ ZEROTH LAW OF THERMODYNAMICS · FIXED POINTS → THERMOMETRY · PYROMETRY · THERMAL EXPANSION · THERMAL ENERGY

LA002 Zeroth law of thermodynamics (*n.*) If two bodies X and Y are each separately in thermal equilibrium with another body Z, then they are in thermal equilibrium with one another. In the most common case the body Z is a thermometer. ↓ TEMPERATURE SCALE · CELSIUS SCALE · FAHRENHEIT SCALE · RÉAUMUR SCALE · IDEAL GAS SCALE · THERMODYNAMIC SCALE ↑ TEMPERATURE

LA003 temperature scale (*n.*) A sequence of values which represent temperature. Such a sequence is usually obtained by choosing two fixed points (identified by specified properties of stated substances) between which there are subdivisions made on a chosen basis. The Celsius scale has 99 divisions between the melting point of pure water and the boiling point of pure water. ↑ ZEROTH LAW OF THERMODYNAMICS

LA004 Celsius scale (*n.*) A temperature scale for which the ice point is at 0° and the steam point is at 100°. One Celsius degree is defined as $^1/_{100}$ of the temperature interval between the ice point and the steam point. ↑ ZEROTH LAW OF THERMODYNAMICS

LA005 Centigrade scale (*n.*) The name formerly used for the Celsius scale. The name is not now used in SI units but is often used by meteorologists. ↑ ZEROTH LAW OF THERMODYNAMICS

LA006 Fahrenheit scale (*n.*) A temperature scale for which the ice point is at 32°F and the steam point at 212°F. Originally the zero was obtained in a freezing mixture and another point was fixed at 96° for blood temperature. ↑ ZEROTH LAW OF THERMODYNAMICS

LA007 Réaumur scale (*n.*) A temperature scale in which the ice point is at 0° and the steam point at 80°. ↑ ZEROTH LAW OF THERMODYNAMICS

LA008 ideal gas scale (*n.*) A scale in which changes of temperature are measured either by changes of pressure, or changes of volume, for gases operating at pressure low enough for the gases to behave as ideal gases. The Celsius temperature θ is defined on the scale by:

$$\theta = \frac{(pV)_\theta - (pV)_0}{(pV)_{100} - (pV)_0} \times 100$$

↑ ZEROTH LAW OF THERMODYNAMICS

LA009 thermodynamic scale (*n.*) A temperature scale which does not depend upon the working properties of any substance. The ideal gas scale is identical with this scale. ↑ ZEROTH LAW OF THERMODYNAMICS

LA010 absolute scale (*n.*) A thermodynamic temperature scale in which the lower fixed point is absolute zero of temperature and the interval is identical with that on the Celsius scale. The temperature on the absolute scale is obtained by adding to θ, the Celsius temperature, $1/\alpha$ where α is the coefficient of expansion of a gas at constant pressure. This gives a scale on which the ice point is 273·15°; *i.e.*

$$°A = °C + 273·15.$$

The absolute scale was often called the Kelvin scale and temperatures measured in °A or °K. In SI units temperature is measured in kelvins (K) by defining the triple point of water as 273·16 K. The ice point is then 273·15 K. The kelvin has the same size as the degree absolute. ↑ ZEROTH LAW OF THERMODYNAMICS

LA011 fixed points (*n.pl.*) Those points on a temperature scale which are fixed and which can be referred to a given property of a substance. The two main fixed points are the ice point and the steam point. ↓ ICE POINT · STEAM POINT · INTERNATIONAL TEMPERATURE SCALE · FUNDAMENTAL INTERVAL · ABSOLUTE ZERO → KELVIN

LA012 ice point (*n.*) That fixed point on a temperature scale at which pure solid water (ice) and pure liquid water are in equilibrium at 101 325 N m^{-2} (760 mm Hg). It may be more simply described as the melting point of pure ice at standard pressure (101 325 N m^{-2} or 760 mm Hg). ↑ FIXED POINTS

LA013 steam point (*n.*) That fixed point on a temperature scale at which pure water boils at standard pressure (101 325 N m^{-2}; 760 mm Hg). This is 100° on the Celsius scale. ↑ FIXED POINTS

LA014 zinc point (*n.*) A fixed point on an international temperature scale, fixed at the temperature at which zinc changes from liquid to solid (the freezing point of zinc) at standard pressure (101 325 N m^{-2}). This corresponds to 419·58°C. ↑ FIXED POINTS

LA015 international temperature scale (*n.*) A practical scale which is as near as possible to the thermodynamic scale but easily referable to a series of fixed points.

Triple point of Hydrogen	−259·34°C
Boiling point of Neon	−246·048°C
Triple point of oxygen	−218·789°C
Boiling point of oxygen	−182·962°C
Triple point of water	0·01°C
Boiling point of water	100·0°C
Freezing point of zinc	419·58°C
Freezing point of silver	961·93°C
Freezing point of gold	1064·43°C

Below 630°C platinum resistance thermometer; up to 1064°C a thermocouple or

special platinum resistance thermometer; above 1064°C a radiation pyrometer. ↑ FIXED POINTS

LA016 fundamental interval (*n.*) The temperature difference associated with the interval between two fixed points (ice point and steam point). The division of this interval into subdivisions will depend upon the temperature scale chosen. ↑ FIXED POINTS

LA017 absolute zero (*n.*) The zero point on an absolute scale of temperature. It is based on a property of gases. The zero point is 273·15 Celsius degrees below the ice point. This puts the ice point on the same scale at 273·15 K (absolute temperature). Absolute zero is the lowest temperature possible; the temperature at which all motion ceases. ↑ FIXED POINTS

LA018 triple point of water (*n.*) The point at which water, ice, and water vapour are simultaneously in equilibrium. The value is 273·16 K. This can be compared with the ice point at 273·15 K. The pressure at the triple point is 101 325 Pa. ↑ FIXED POINTS

LA019 thermometric liquid (*n.*) An alternative term for a WORKING FLUID in a thermometer when that substance is a liquid. ↓ THERMOMETRY ↑ TEMPERATURE SCALE · FIXED POINTS

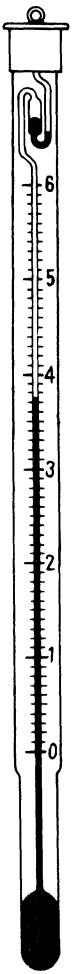
LA020 thermometry (*n.*) The study and activity of measuring temperature. To do this a **working substance** must be used, *e.g.* mercury, alcohol, air, hydrogen, platinum, One must then choose the suitable property of the working substance which is a function of temperature, *e.g.* expansion, electrical resistance, thermoelectric effect. For temperatures above 500°C the term **pyrometry** is used. ↓ MERCURY-IN-GLASS THERMOMETER · GAS THERMOMETER · TEMPORARY DEPRESSION OF ZERO · RESISTANCE THERMOMETER · THERMOSTAT ↑ TEMPERATURE

LA021 mercury-in-glass thermometer (*n.*) This is the commonest type of thermometer used. Mercury has a sufficiently high coefficient of expansion; it is opaque, does not wet glass, and is a good conductor of heat. Its melting point is −39°C and its boiling point 357°C. By filling the empty space above the mercury with nitrogen to increase the pressure, the thermometer can be used up to 500°C. The thermometer has a bulb which is a reservoir for the mercury. This leads into a fine capillary tube. A rise in temperature causes the mercury to expand up the capillary. The capillary is calibrated for the chosen temperature scale (usually the Celsius scale). ↓ ETHANOL-IN-GLASS THERMOMETER · PENTANE-IN-GLASS THERMOMETER · BECKMANN THERMOMETER · MERCURY-IN-STEEL THERMOMETER ↑ THERMOMETRY

LA022 ethanol-in-glass thermometer (*n.*) A thermometer containing ethanol as its working substance. Ethanol freezes at −117°C and so is useful for low temperature work. Its coefficient of expansion is six times as great as that of mercury. Usually a red dye is added to make the ethanol visible. ↑ MERCURY-IN-GLASS THERMOMETER

LA023 pentane-in-glass thermometer (*n.*) A thermometer containing liquid pentane as the working substance. It is useful for low-temperature work down to −200°C. ↑ MERCURY-IN-GLASS THERMOMETER

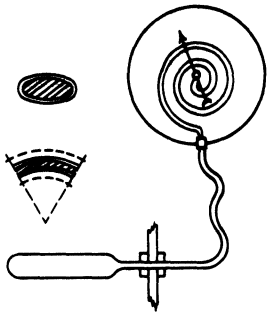
LA024 vapour pressure thermometer (*n.*) A thermometer that makes use of rapid change in vapour pressure with temperature. A suitable liquid is placed in a bulb and connected to a pressure gauge which is used graduated for temperatures. By a choice of suitable liquids this type of thermometer can be used over a wide range of temperature. ↑ MERCURY-IN-GLASS THERMOMETER



BECKMANN THERMOMETER

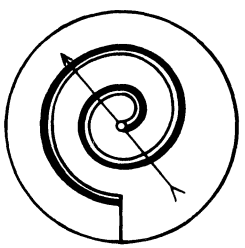
LA025 Beckmann thermometer (*n.*) A special form of mercury-in-glass thermometer

designed to measure small temperature differences. It has two reservoirs for the mercury, allowing the short scale of 6°C to be used at any point in the Celsius range. The scale on the thermometer reads to ·01°C. ↑ MERCURY-IN-GLASS THERMOMETER



MERCURY-IN-STEEL THERMOMETER

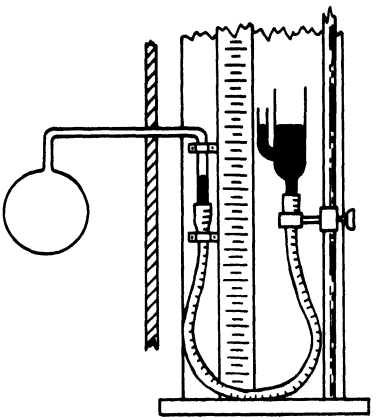
LA026 mercury-in-steel thermometer (*n.*) A type of thermometer that has a steel bulb and a flexible steel capillary tube for its stem. This joins into a flat thin-walled steel tube wound into a flat spiral. The whole is filled with mercury. Increase in temperature causes volume changes which in turn cause the thin-walled flat tube to become more circular. This causes the spiral to open like a pressure guage and temperature can be recorded on a calibrated circular scale. ↑ MERCURY-IN-GLASS THERMOMETER



BIMETALLIC THERMOMETER

LA027 bimetallic thermometer (*n.*) A type of thermometer that depends on expansion of a solid. A strip of brass and a strip of iron are riveted together. When heated the bimetallic strip bends because brass has a higher coefficient of linear expansion than iron. If the bimetallic strip is cooled, the coil will open up. This movement can be recorded on a calibrated scale. ↑ MERCURY-IN-GLASS THERMOMETER

LA028 gas thermometer (*n.*) In a gas thermometer the working substance is a gas and the property is change of volume with temperature or change of pressure with temperature. The error resulting from the expansion of the bulb is small. The thermometer can be used over a wide range of temperatures. There are a number of gases suitable for this type of thermometer. ↓ CONSTANT VOLUME GAS THERMOMETER · CONSTANT VOLUME HYDROGEN THERMOMETER ↑ THERMOMETRY



CONSTANT-VOLUME GAS THERMOMETER

LA029 constant-volume gas thermometer (*n.*) In this type of gas thermometer the property of the working substance is change of pressure with temperature while volume remains constant. If the volume V of a fixed mass of gas is maintained constant, the pressure is proportional to the absolute temperature. Pressure P_0 is measured at ice point and pressure P_{100} is measured at the steam point. An unknown temperature θ may be evaluated on the Celsius scale by measuring P_θ, the pressure at that temperature. Thus:

$$\theta = \frac{P_\theta - P_0}{P_{100} - P_0} \times 100$$

$P_{100} - P_0$ is the fundamental interval of any specified instrument of this kind. ↑ GAS THERMOMETER

LA030 constant-volume hydrogen thermometer (*n.*) A type of constant-volume thermometer in which hydrogen is the gas and the bulb is a platinum-iridium alloy. It is standardized for temperatures from −260°C to 1600°C. At temperatures above 500°C nitrogen replaces the hydrogen because hydrogen diffuses too quickly through the metal. ↑ GAS THERMOMETER

LA031 helium vapour pressure thermometer (*n.*) A type of vapour pressure thermometer in which liquid helium is used in the bulb with a suitable manometer. The instrument is useful from 1 K to 4 K. ↑ MERCURY-IN-GLASS THERMOMETER

LA032 temporary depression of zero (*n.*) An effect resulting from placing a glass thermometer in cold water, etc., after the thermometer has been heated to a higher temperature. The glass of the bulb does not return to its original volume as rapidly as the

mercury does; this may result in a zero value temporarily lower than it should be. ↓ SECULAR DEPRESSION OF ZERO · EMERGENT STEM CORRECTION · DEAD SPACE

LA033 secular depression of zero (*n.*) A type of error caused by the very slow cooling of the thermometer glass after manufacture. Frequent checking of the ice point makes it possible to eliminate this error. ↑ TEMPORARY DEPRESSION OF ZERO

LA034 emergent stem correction (*n.*) When a thermometer is calibrated for the steam point, the whole stem is in the steam. If in use the stem is at the normal air temperature, there will be an error in the reading. At high temperatures this may be as much as 1°C or 2°C. Correction can be obtained from tables or by calculation. ↑ TEMPORARY DEPRESSION OF ZERO

LA035 dead space (*n.*) In a gas thermometer there may be a small volume of air in the connecting tube between the bulb and the pressure manometer. This space is called the dead space. There is a compensation for this in certain types of gas thermometer. ↑ TEMPORARY DEPRESSION OF ZERO

LA036 resistance thermometer (*n.*) A type of thermometer in which electrical resistance is the property which is temperature dependent. Usually, platinum is the working substance. Other metals could be used but platinum has a high melting point (1773°C); it is resistant to corrosion, and the commercial product has a high degree of purity. The resistance may be determined by putting the thermometer in as one arm of a Wheatstone bridge using a compensation for the leads. The thermometer is calibrated for three fixed points: ice point, steam point, and sulphur point. If it is to be used for low temperatures an oxygen point may also be fixed, or perhaps comparison made with a gas thermometer. For a given instrument a graph can be prepared. Also the constants for the thermometer can be determined and thereafter temperatures calculated. ↓ THERMOELECTRIC THERMOMETER ↑ THERMOMETRY → THERMISTOR

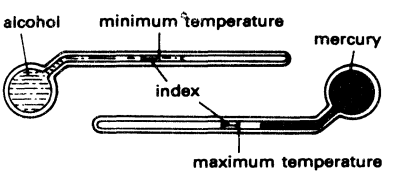
LA037 thermoelectric thermometer (*n.*) A thermocouple provides another combination of working substance and property. Such a thermometer can be used in special situations unsuitable for more conventional thermometers. If intended for high temperature work it may be called a thermoelectric pyrometer. Sensitivity varies with the nature of the couple and this in turn depends on the temperature range within which the couple is used. A couple of chromel/alumel (an alloy) has a sensitivity of 40 microvolts per degree. It can be used continuously at 1100°C. ↑ RESISTANCE THERMOMETER

LA038 thermostat (*n.*) A device for maintaining a constant temperature. If the thermostat has been set, a fall in temperature causes the thermostat to activate the heating source and vice versa. A constant or near constant temperature is obtained in this way. Bimetalic strips are used as the activating unit in some thermostats, especially for electric current control. Expansion of a solid or liquid can be used for a gas-heated thermostat. ↓ CRYOSTAT · TEMPERATURE RECORDER · MAXIMUM AND MINIMUM THERMOMETERS · CLINICAL THERMOMETER[1]

LA039 cryostat (*n.*) A thermostat for low temperature work. Such a device can operate on the jacket-filled-with-vapour principle. For low temperatures a liquefied gas maintained at a suitable pressure in a Dewar flask and boiling may be used. ↑ THERMOSTAT

LA040 temperature recorder (*n.*) An instrument for providing a record of temperature with time. A number of thermometers can be used in temperature recording instruments. Mercury in glass can be recorded photographically but more usually less expensive pen traces on special lined paper on a rotating cylinder driven by a clock mechanism are used. The most suitable thermometers are the bimetallic and the mercury in steel (or other suitable metal). Vapour pressure thermometers can also be used. If thermoelectric thermometers are used, direct recording from the appropriate electrical device is possible.

LA041 maximum and minimum thermometers (*n.*) These are thermometers which give a record of the maximum and/or minimum temperatures reached during a specified period. **1 minimum thermometer** This is an alcohol (ethanol) thermometer. In the stem is a small solid indicator with a light spring which holds it against the glass. In a horizontal thermometer it may be small piece of coloured glass. As temperature falls the concave meniscus of the alcohol draws the indicator back until a minimum is reached. Any rise leaves the indicator behind. The indicator is replaced either by sliding it back (glass), or by drawing it back with a magnet (steel).

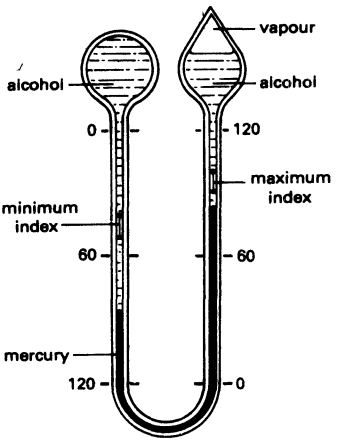


MAXIMUM AND MINIMUM THERMOMETERS

2 maximum thermometer This is a mercury thermometer. The convex meniscus carries the indicator up (along in a horizontal thermometer) and leaves it at the maximum point. The indicator is recovered as for a minimum thermometer.

3 Six's maximum and minimum thermometer The diagram makes clear how this works. The working substance originally used was alcohol. The expanding alcohol moves mercury in a U-tube. The concave

meniscus of the mercury records the temperature. It must record the same temperature at each mercury meniscus. Oil of creosote is now used in place of alcohol. ↑ THERMOSTAT



SIX'S MAXIMUM AND MINIMUM THERMOMETER

LA042 index (*n.*) The term used for the indicator in maximum and minimum thermometers. ↑ THERMOSTAT

LA043 clinical thermometer[1] (*n.*) A mercury-in-glass thermometer with a constriction in the capillary tube which prevents mercury in the stem from flowing back into the reservoir. After the temperature has been recorded the mercury can be shaken down again. Because it is used for measuring human or animal body temperatures it has a very much restricted scale. In Great Britain these thermometers are graduated on the Fahrenheit scale. In Europe and a number of other places a Celsius scale is used. ↑ THERMOSTAT

LA044 pyrometry (*n.*) The measurement of high temperatures (above about 500°C). → THERMOMETRY · TEMPERATURE · RADIATION

LA045 thermal expansion (*n.*) Increase in length, area, or volume, of a body or quantity of matter, because of rise in temperature. In the case of solids the study is made of those substances which have the same properties in all directions (isotropic solids). ↓ EXPANSION OF SOLIDS · EXPANSION OF LIQUIDS · EXPANSION OF GASES · COMPARATOR METHOD → TEMPERATURE

LA046 expansion of solids (*n.*) Rise in temperature causes a change in size, but not in shape, of the body expanding, if it is isotropic, *i.e.* the length, breadth and depth will all increase in the same proportion. ↓ COEFFICIENT OF LINEAR EXPANSION · MEAN COEFFICIENT OF LINEAR EXPANSION · ABSOLUTE COEFFICIENT OF LINEAR EXPANSION · COEFFICIENT OF SUPERFICIAL EXPANSION · COEFFICIENT OF CUBICAL EXPANSION ↑ THERMAL EXPANSION

LA047 coefficient of linear expansion The fractional change in the length of a body per degree Celsius. This may be either the mean coefficient or the true coefficient. Coefficients of linear expansion are usually not large, *e.g.* for copper 0·000 016 cm per °C. ↑ EXPANSION OF SOLIDS

LA048 mean coefficient of linear expansion (*n.*) This is the coefficient determined by measuring the increase in length over a range of temperature:

$$\text{mean coefficient} = \frac{1}{l_1}\left(\frac{l_2 - l_1}{\theta_2 - \theta_1}\right)$$

↑ EXPANSION OF SOLIDS

LA049 absolute coefficient of linear expansion (*n.*) This is the coefficient expressed as:

$$\frac{1}{l}\frac{\mathrm{d}l}{\mathrm{d}\theta}$$

i.e. the rate of increase of length with temperature expressed as a fraction of the length at θ °C. ↑ EXPANSION OF SOLIDS

LA050 coefficient of superficial expansion (*n.*) The coefficient of expansion of area. For linear expansion, $l_\theta = l_0(1 + \alpha\theta)$, where l_θ is the length at temperature θ, l_0 the length at zero temperature, and α the coefficient of linear expansion. The area at temperature θ is A_θ, which equals l_θ^2. Therefore:

$$A_\theta = l_0^2\,[1 + 2\alpha\theta + (\alpha\theta)^2].$$

l_0^2 is equal to A_0, the area at zero temperature. As α is very small $(\alpha\theta)^2$ can be disregarded. Thus $A_\theta = A_0\ (1 + 2\alpha\theta)$. The coefficient of superficial expansion is $\beta\ (=2\alpha)$. It is equal to 2 × coefficient of linear expansion, if the substance is isotropic. ↑ EXPANSION OF SOLIDS

LA051 coefficient of cubical (volume) expansion (*n.*) The coefficient of expansion of volume. It can be shown in a similar manner to the coefficient of superficial expansion, that $V_\theta = V_0[1 + 3\alpha\theta]$, where V_θ is the volume at temperature θ, V_0 the volume at zero, and α the coefficient of linear expansion. The coefficient of volume expansion is $\gamma\ (= 3\alpha)$. It is equal to 3 × coefficient of linear expansion, if the substance is isotropic. ↑ EXPANSION OF SOLIDS

LA052 expansion of liquids (*n.*) The coefficients of expansion of liquids are usually of a higher order of magnitude than for solids, *e.g.* the coefficient of expansion of ethanol is 0·0011cm² per °C. For mercury the value is 0·00018 per °C. The expansion may be measured, *a* by the change in level in a graduated vessel (**volume dilatometer**); *b* by measuring the mass of the liquid which just fills a vessel at the required temperature (**mass dilatometer**); *c* by using a hydrometer in the liquid at the given temperature; *d* by balancing columns of hot and cold liquids. ↓ MEAN COEFFICIENT OF LIQUID EXPANSION · ZERO COEFFICIENT OF LIQUID EXPANSION · COEFFICIENT OF APPARENT EXPANSION · COEFFICIENT OF ABSOLUTE EXPANSION ·

VOLUME DILATOMETER · MASS DILATOMETER · EXPANSION OF WATER ↑ THERMAL EXPANSION

LA053 mean coefficient of liquid expansion (*n.*) This is represented as:

$$\frac{1}{V_1}\left(\frac{V_2 - V_1}{\theta_2 - \theta_1}\right)$$

This measures the coefficient as a mean over a range of temperature. ↑ EXPANSION OF LIQUIDS

LA054 zero coefficient of liquid expansion (*n.*) This is expressed as:

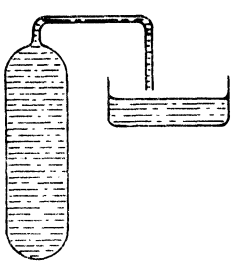
$$\frac{1}{V_0} \cdot \frac{dV_\theta}{d\theta}$$

This could be obtained by plotting a curve of volume against temperature for a given liquid. The value of $dV_\theta d\theta$ will be given by the slope of the curve; at the point where the temperature is 0°C. ↑ EXPANSION OF LIQUIDS

LA055 coefficient of apparent expansion of a liquid (*n.*) Experiments must be carried out with the liquid in a containing vessel. This is usually glass which has a coefficient of cubical expansion. Note: it can be shown that an empty spherical vessel expands as though it were solid glass. The coefficient of liquid expansion found will therefore be less than the true value. The surface of a liquid falls slightly when the liquid is warmed because of the expansion of the glass. ↑ EXPANSION OF LIQUIDS

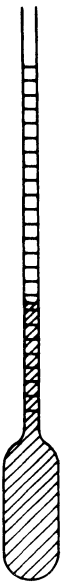
LA056 coefficient of absolute expansion of a liquid (*n.*) A coefficient found by methods which compensate for the expansion of the glass. ↑ EXPANSION OF A LIQUID

LA057 volume dilatometer (*n.*) A vessel with a graduated tube used to find the increase in volume of a liquid on expansion at a given temperature, *i.e.* it measures the volume of the liquid at the higher temperature. ↑ EXPANSION OF LIQUIDS



MASS DILATOMETER

LA058 mass dilatometer (*n.*) A device which allows the mass of liquid to be measured which fills the dilatometer to a marked level. The mass of liquid which fills it at other temperatures can then be measured. Pyknometers and relative density bottles can be used. The device has also been called a ***weight thermometer***. ↑ EXPANSION OF LIQUIDS



VOLUME DILATOMETER

LA059 weight thermometer (*n.*) Alternative term for MASS DILATOMETER. ↑ EXPANSION OF LIQUIDS

LA060 expansion of water (*n.*) The expansion of water follows an irregular pattern. Expansion between 10°C and 30°C is only half that between 30°C and 50°C. Below 10°C there is a small contraction as temperature falls, but from 4°C to 0°C there is a small expansion. This leads to water (H_2O) having a maximum density at 4°C. For heavy water (D_2O) the maximum density is at 10°C. ↑ EXPANSION OF LIQUIDS

LA061 expansion of gases (*n.*) The thermal expansion of gases at constant pressure is covered by CHARLES' LAW. The coefficient of expansion of a gas is stated to be $\frac{1}{273}$. This leads to the statement of a scale of temperature (the Absolute Scale) for which −273°C is Absolute Zero. ↑ EXPANSION OF SOLIDS · EXPANSION OF LIQUIDS · THERMAL EXPANSION

LA062 comparator method (*n.*) There are a variety of methods for the measurement of a coefficient of expansion of a solid, if a regular solid is available. This method uses a device for comparing standard lengths. Fine scratches on a rod are observed by two travelling microscopes. This allows the amount of expansion to be measured at any chosen temperature. This will give $l_{\theta_1} - l_{\theta_2}$. l_{θ_1} can be obtained by replacing the sample

with a standard scale at the required temperature with the travelling microscopes in the θ_1 position. ↓ COMPENSATION ↑ THERMAL EXPANSION

LA063 compensation (*n.*) There are many situations in which metals are used when expansion may adversely affect the instrument, device, or machine. In countries where there is a large seasonal or diurnal variation in temperature this may be sufficiently important for compensation to be made, *e.g.* ***a*** the balance wheel of a watch will expand and alter its moment of inertia; compensation is achieved by dividing the circumference into three parts and making each section a bimetallic strip. The expansion of the radial arm of the wheel is compensated for by a curving in the sections of the circumference; ***b*** pendulums must be compensated where they are still used in large clocks; ***c*** railway lines, bridges, etc., will expand with changes of temperature and there must be compensation. ↑ EXPANSION OF SOLIDS

Transfer of Heat

LB001 thermal conduction (*n.*) The process of transfer of heat through a body without visible motion of any part of the body. The process takes place where there is a temperature gradient. The heat energy diffuses through the body by the action of particles of high kinetic energy on particles of lower kinetic energy. For solids with metallic bonding these particles will be electrons. For solids with ionic structure the particles will be ions and for solids with covalent bonding they will be molecules. In the two latter cases motion will be restricted to vibrations about fixed positions. The energy is transferred in the last two cases by high frequency waves. —THERMAL CONDUCTIVITY, THERMAL CONDUCTOR (*n.*) ↓ THERMAL CONDUCTOR · LAG[1] → CONVECTION · RADIANT HEAT · HEAT CAPACITY

LB002 thermal conductor (*n.*) A substance which conducts heat. All substances will do this in very varying degrees. Metals are good thermal conductors while nonmetals are poor (bad) thermal conductors. In general, substances which do not have free electrons are bad thermal conductors. These will include plastics and glasses. Gases and liquids are also bad thermal conductors. —THERMAL CONDUCTIVITY, THERMAL CONDUCTION (*n.*) ↓ THERMAL INSULATOR · LAGGING · THERMAL CONDUCTIVITY

LB003 thermal insulator (*n.*) A substance with a low thermal conductivity, *e.g.* cork, expanded polystyrene, glass fibre and glass wool, various textiles, air and other gases. —INSULATION (*n.*) INSULATE[1] (*v.*) INSULATED (*adj.*) ↑ THERMAL CONDUCTOR

LB004 lagging (*n.*) A process used to reduce heat flow by conduction. This may be the wrapping of hot-water pipes with a bad conductor to keep heat in or packing the case of a refrigerator outside with something like expanded polystyrene or fibreglass to keep heat out. —LAG (*v.*) LAGGED (*adj.*) ↑ THERMAL CONDUCTOR

LB005 thermal conductivity (*n.*) A measure of the ability of a substance to conduct heat. The relation between rate of heat flow $(dq)/(dt)$, area of cross-section (A), thermal conductivity (K), and temperature gradient $(d\theta)/(dz)$ is:

$$\frac{dq}{dt} = KA\,\frac{d\theta}{dz}$$

If the units of rate of heat flow are joules per second, A is in metres squared, and the temperature gradient in kelvins per metre, then K has units of joules per second per metre per kelvin ($J\ m^{-1}\ s^{-1}\ K^{-1}$), or watts per metre per kelvin ($W\ m^{-1}\ K^{-1}$). The thermal conductivity can be stated as the amount of heat that flows in unit time from one face of a unit cube to the opposite face when there is a unit temperature difference between these faces. ↑ THERMAL CONDUCTOR · THERMAL CONDUCTION

LB006 lag[1] (*v.t.*) To carry out the process of lagging on an object, *e.g.* to lag cold water pipes to prevent freezing in very cold weather or hot water pipes to prevent loss of heat. —LAGGING (*n.*) LAGGED (*adj.*) ↑ THERMAL CONDUCTION

LB007 insulate[1] (*v.t.*) To prevent energy passing via a conductor to another place by interposing a suitable bad conductor; to cover the walls of a room inside, or pack between the walls with polystyrene or other foam or with fibreglass, to prevent heat loss. In hot countries efforts are made to insulate against heat, *i.e.* to keep it out of rooms or houses. —INSULATOR, INSULATION (*n.*) ↑ LAG[1] (H)

LB008 convection (*n.*) The process of heat transfer in a fluid, caused by movement of the fluid itself. —***convector*** (*n.*) ***convect*** (*v.*) ↓ CONVECTION CURRENT · LAND BREEZE ↑ THERMAL CONDUCTION

LB009 convection current (*n.*) A stream of fluid arising from differences of pressure in the fluid which in turn result from temperature differences. In a liquid the hot spaces in the liquid will be less dense and therefore exert less pressure. Cold parts will move to the hot parts and convection currents will be set up. ↓ LAND BREEZE ↑ CONVECTION

LB010 land breeze (*n.*) A breeze blowing from the land towards the sea and caused by convection currents in the air. The sea has a higher specific heat capacity than the land. It therefore heats up and cools more slowly than the land. At night the land is cooler

than the sea and so a flow of air is set up from the land to the sea because there is a pressure difference. ↑ CONVECTION CURRENT · CONVECTION

LB011 sea breeze (*n.*) A breeze blowing from the sea to the land. It is set up for the same reasons as the land breeze. This takes place in the day time, the land being hotter than the sea. The convection current flows in a clockwise direction. Over the hot land there is a low pressure area; over the sea a higher pressure area, therefore the flow will be from sea to land. ↑ LAND BREEZE

LB012 monsoon (*n.*) A general weather condition of wind set in a permanent direction and usually bearing rain. A wind of this kind blows from the south west across the Indian ocean. It is the lower half of a vast convection current. The hot continental land mass forms an area of low pressure (high temperature and low density, therefore low pressure). Cold air from the high pressure areas over the cooler sea flows towards the hot low pressure areas. ↑ LAND BREEZE

LB013 radiant heat (*n.*) Radiant heat consists of invisible electromagnetic waves in the infra-red region of the spectrum which are able to pass through a vacuum. They can be both absorbed and reflected by matter, *e.g.* ***a*** the hot wire in a coil in an electric heater emits radiant heat – an object placed in front of the fire absorbs the waves and becomes hot; ***b*** in a vacuum-filled electric lamp radiant heat falls on the glass (having passed through the vacuum); it is absorbed by the glass which becomes hot; ***c*** a metal reflector (mirror) will reflect the radiant heat from a source at its focus. ↓ RADIATION · THERMOPILE[1] · VACUUM FLASK · RADIATE[3] · DIATHERMANOUS

LB014 radiation (*n.*) A process by which energy is transmitted as electromagnetic waves. Thermal radiation is emitted from hot bodies. The quantity and quality (frequency) depend on the temperature of the body. It is that radiation from a body which depends only on temperature. —RADIATE (*v.*) ↓ THERMAL ABSORPTION · THERMAL EMISSION · THERMAL ABSORBER · THERMAL EMITTER ↑ RADIANT HEAT

LB015 thermal absorption (*n.*) The process of absorbing radiant heat. Absorption of radiant heat raises the temperature of the body absorbing the energy by increasing the kinetic energy of the particles. —THERMAL ABSORBER (*n.*) ↓ THERMAL EMISSION (Cn)

LB016 thermal emission (*n.*) The process of emitting radiant heat. When the kinetic energy of particles falls, energy may be given out and emitted as radiant heat. —THERMAL EMITTER (*n.*) ↑ RADIATION · THERMAL ABSORPTION (Cn)

LB017 thermal absorber (*n.*) A body which absorbs thermal radiation. Dark surfaced bodies are the best absorbers while bright polished surfaces, as in polished silver, absorb the least. Such polished surfaces are good reflectors of radiant heat. —THERMAL ABSORPTION (*n.*) ↓ THERMAL EMITTER (Cn) ↑ RADIATION

LB018 thermal emitter (*n.*) A body which emits thermal radiation (radiant heat). Good absorbers are also good emitters so that black surfaced bodies emit very well but shiny white or polished surfaces very poorly. A surface coated with lamp black or platinum black has an absorptivity very close to unity. A little radiant heat is lost by diffuse reflection. —THERMAL ABSORPTION (*n.*) ↑ RADIATION · THERMAL ABSORBER (Cn)

LB019 thermopile[1] (*n.*) An instrument for detecting and measuring radiant heat. The heat energy is converted into electrical energy using the principle of the thermocouple. Some 64 couples are joined in series and packed to display the junctions as a surface. ↓ BOLOMETER[1] ↑ RADIANT HEAT

LB020 bolometer[1] (*n.*) An instrument for measuring radiant heat, consisting of a thin strip of platinum foil coated with platinum black to give maximum absorptivity. The strip is used as one arm of a Wheatstone bridge. The resistance of platinum changes rapidly with temperature and this change can be measured with the Wheatstone bridge. The instrument may be calibrated. ↑ THERMOPILE[1]

LB021 Newton's law of cooling (*n.*) The law states that a body loses heat at a rate proportional to the difference in temperature between the body and the surroundings, provided that the temperature of the body is higher than the temperature of the surroundings. ↓ STEFAN'S LAW ↑ RADIANT HEAT

LB022 Stefan's law (*n.*) The law connects radiant flux per unit area, M_e, with temperature, T:

$$M_e = \sigma T^4$$

σ is a constant known as Stefan's constant. ↑ NEWTON'S LAW OF COOLING

LB023 vacuum flask (*n.*) A flask or vessel designed originally by Dewar for liquid oxygen, nitrogen, etc. The purpose was to keep the liquids cool, *i.e.* to prevent heat passing into the liquids. It is a double glass vessel evacuated to a near vacuum between the inner and outer shells. Convection is thus reduced to a minimum. The glass surfaces are silvered to reduce radiation losses to a minimum. The whole is insulated by cork pads from the container to reduce conduction to a minimum. The flask can also be used to keep hot things hot. Also called a ***Dewar flask***. ↓ GREENHOUSE · GREENHOUSE EFFECT ↑ RADIANT HEAT

LB024 greenhouse (*n.*) A building made of glass for use in cold or temperate climates for growing plants which need warmth. The sun emits heat radiation in both the visible range as light, and in the short wave length infra-red. This short wave infra-red radiation passes through the glass without being absorbed. The earth, brickwork, floor, etc., absorb the radiation. The temperature of the air is raised mainly by convection. The warm objects also radiate heat but at a much

lower temperature than the sun. The resulting infra-red radiation is of longer wave length and cannot pass through the glass. ↑ VACUUM FLASK

LB025 greenhouse effect (*n.*) Any effect similar to that in a glass greenhouse, *i.e.* short infra-red rays pass through the glass but long infra-red rays do not pass through the glass. Short infra-red rays pass through a layer of carbon dioxide but the long infra-red rays do not. If a layer of carbon dioxide builds up in the atmosphere short infra-red rays from the sun will pass through and be absorbed by the ground (earth, buildings, sea, etc.). These will emit long infra-red rays which will not pass through the carbon dioxide. This results in a permanent build-up of heat energy causing a temperature rise. ↑ VACUUM FLASK

LB026 radiate[3] (*v.i.*) To emit radiation (energy in the form of waves), *e.g.* a hot body radiates heat (radiant heat); an electric light bulb emits radiation in the visible and infra-red regions of the electromagnetic spectrum. —RADIATION (*n.*) ↑ RADIATION

LB027 diathermanous (*adj.*) Describes a substance which is transparent to infra-red radiation, *e.g.* rock salt, quartz, and carbon disulphide, are diathermanous. —***diathermancy*** (*n.*) ↓ ADIATHERMANOUS (Ag) ↑ RADIANT HEAT · RADIATION · THERMOPILE[1] · NEWTON'S LAW OF COOLING · VACUUM FLASK · RADIATE[3]

LB028 adiathermanous (*adj.*) Describes a substance which does not transmit certain infra-red radiation, *e.g.* glass is diathermanous to shortwave infra-red radiation but adiathermanous to long wave infra-red. ↑ DIATHERMANOUS (Ag)

LB029 heat capacity (*n.*) The heat capacity of a body (solid, liquid, or gas) is the heat required to raise its temperature by one kelvin. Heat capacity is measured in joules per kelvin ($J\ K^{-1}$) The term ***thermal capacity*** is also used. It can be calculated by multiplying the mass of a body by its specific heat capacity. ↓ SPECIFIC HEAT CAPACITY · LATENT HEAT

LB030 specific heat capacity (*n.*) The specific heat capacity of a substance is the heat energy required to raise unit mass of the substance through one kelvin. The SI units are $J\ kg^{-1}\ K^{-1}$. ↓ SPECIFIC HEAT · MOLAR HEAT CAPACITY · WATER EQUIVALENT ↑ HEAT CAPACITY

LB031 specific heat (*n.*) Obsolete term for SPECIFIC HEAT CAPACITY(↑).

LB032 molar heat capacity (*n.*) The heat required to raise one mole of a substance through one kelvin. This is obtained by the product of the molar mass and specific heat capacity, *e.g.* for copper the specific heat capacity is $400\ J\ kg^{-1}\ K^{-1}$. The molar heat capacity will be $400 \times 63{\cdot}5\ J\ mol^{-1}\ K^{-1}$

LB033 water equivalent (*n.*) Obsolete term for HEAT CAPACITY. ↑ SPECIFIC HEAT CAPACITY

LB034 latent heat (*n.*) Heat energy given out or taken in during change of state The change from solid to liquid is endothermic, *i.e.* the heat content (enthalpy) of the liquid is higher than that of the solid. In this sense the heat energy is latent: $H_2O_{(s)} \rightarrow H_2O_{(l)}$. ΔH for the change has a positive value. ↑ HEAT CAPACITY ↓ SPECIFIC LATENT HEAT · TROUTON'S LAW → EVAPORATION

LB035 specific latent heat (*n.*) The quantity of heat required to change unit mass of a solid to liquid, or liquid to gas, without change of temperature. **Specific latent heat of fusion** is the quantity of heat required to change unit mass of a substance from the solid state to the liquid state without change of temperature, *e.g.* the SLH of Fusion for $H_2O_{(s)}$ is 336 $kJ\ kg^{-1}$. Symbol (*l*); SI units joules per kilogramme $J\ kg^{-1}$. **Specific latent heat of vaporization** is the quantity of heat required to change unit mass of a substance from the liquid state to the vapour state without change of temperature. Symbol (*l*). SI units joules per kilogramme ($J\ kg^{-1}$), *e.g.* the specific latent heat of vaporization for $H_2O_{(l)}$ is 2260 ($kJ\ kg^{-1}$) (kilojoules per kilogramme). ↑ LATENT HEAT

LB036 Trouton's rule (*n.*) The rule that the ratio of molar latent heat of vaporization to its boiling point (absolute scale) is a constant for all substances whose vapours are not associated, *e.g.* for water it is 2260 $kJ\ kg^{-1}$, the formula weight is 18, and boiling point 373 K. The value of the ratio is 87 $J\ mol^{-1}\ K^{-1}$. Note: this rule has a number of exceptions, *e.g.* helium, which has one quarter of the value. If there is association in the vapour state the rule will not hold. ↑ LATENT HEAT

LB037 fusion (*n.*) In the context of heat, fusion is the process of change from solid to liquid. In some contexts it implies the process of joining together by melting (fusing). —FUSE (*v.*) ↓ REGELATION ↑ HEAT CAPACITY → FUSE · MELTING (Sn) · FREEZING (Cn) · SOLIDIFICATION (Cn)

LB038 regelation (*n.*) When water freezes there is an increase in volume. Pressure therefore will favour the change

$$H_2O_{(s)} \rightarrow H_2O_{(l)}$$

i.e. the freezing point will be lowered. When two blocks of ice are pressed together, melting takes place at the faces in contact. In order to melt, ice must take up 336 joules per gramme; it does this from the surrounding ice. The temperature of the surrounding ice will fall below 273 K. When the pressure is removed the liquid film will freeze again giving its latent heat to the surrounding ice which is below 273 K. The process is regelation (re-solidification). ↑ FUSION

LB039 calorimetry (*n.*) The branch of physics concerned with heat measurement. —***calorimeter*** (*n.*) ↓ METHOD OF MIXTURES · ADIABATIC CALORIMETER ↑ HEAT CAPACITY

LB040 method of mixtures (*n.*) A method of calorimetry in which a known mass of substance, liquid or solid, of unknown heat capacity, is added to a liquid of known heat capacity and at a different temperature in a

calorimeter. The change of temperature is noted and the unknown heat capacity obtained by equating heat lost by one to the heat gained by the other. ↑ CALORIMETRY

LB041 adiabatic calorimeter (*n.*) A calorimeter with a jacket maintained at the same temperature as the outside of the calorimeter. In such a calorimeter there can be no heat lost to the surroundings. ↑ CALORIMETRY

LB042 bomb calorimeter (*n.*) A device for measuring the heat evolved during combustion of a fuel, consisting of a thick-walled steel container. A known amount of the fuel is ignited in the container in an atmosphere of compressed oxygen. The container (the bomb) is immersed in a known volume of water and the measured rise in temperature allows the calorific value to be calculated. ↑ CALORIMETRY

Chemical Energy

LC001 chemical energy (*n.*) The energy set free in a chemical change. It results from the making and breaking of bonds during the reaction, *e.g.* when petrol burns in a cylinder of an internal combustion engine the energy produced is chemical energy. It is a form of potential energy. → THERMOCHEMISTRY · LAWS OF THERMODYNAMICS

LC002 explode (*v.t.,i.*) **1** (*v.i.*) To undergo a large sudden increase in volume resulting from the release of energy, usually leading to rise of temperature, emission of light, and production of sound, and resulting in an increase in pressure which destroys surrounding materials. **2** (*v.t.*) To cause an explosion, *e.g.* to explode a mixture of hydrogen and oxygen by an electric spark. —***explosion*** (*n.*) ***explosive*** (*adj.*) ↑ CHEMICAL ENERGY

LC003 incandescent (*adj.*) At such a high temperature that the material glows and emits light in the visible spectrum, *e.g.* cerium and thorium oxides in a gas mantle (aladdin lamp), or calcium oxide emitting intense white light, called limelight. —***incandescence*** ↑ CHEMICAL ENERGY

LC004 explosive (*adj.*) (Of a reaction) taking place very rapidly, with the evolution of energy and sometimes with rapid and large expansion. The effect is to produce an explosion, *e.g.* in gunpowder, sulphur and carbon burn explosively with oxygen from potassium nitrate. —EXPLODE (*v.*) ***explosion*** (*n.*) ***explosively*** (*adv.*) ↑ CHEMICAL ENERGY

Thermochemistry

LD001 thermochemistry (*n.*) The study of changes in heat energy which take place in chemical reactions or changes, *e.g.* when 1 dm^3 of 1 M sodium hydroxide solution is neutralized by 1 dm^3 of 1 M hydrochloric acid, 57·3 kJ of energy are given out. This energy raises the temperature of the solution. —***thermochemical*** (*adj.*) ↓ HEAT OF COMBUSTION · THERMOCHEMICAL EQUATION · EXOTHERMIC → CHEMICAL ENERGY · HESS' LAW · BOMB CALORIMETER

LD002 heat of reaction (*n.*) The heat energy change when a reaction takes place between the masses of reactants indicated by the equation of the reaction or change. ↓ HEAT OF COMBUSTION · HEAT OF FORMATION · HEAT OF SOLUTION · HEAT OF NEUTRALIZATION ↑ THERMOCHEMISTRY

LD003 heat of combustion (*n.*) The heat energy produced when 1 mole of a substance is completely burned in oxygen, *e.g.*

$$CH_{4(g)} + 2O_{2(g)} = CO_{2(g)} + 2H_2O_{(l)}; \quad \Delta H = -889 \text{ kJ}$$

The figure −889 kJ is the enthalpy change and, by convention, it is negative when heat is given out. ↓ ENTHALPY ↑ HEAT OF REACTION

LD004 heat of formation (*n.*) The heat energy evolved or absorbed when one mole of a given compound is formed from its elements in the standard states, *e.g.* carbon disulphide:

$$C_{(s)} \text{ (graphite)} + 2S_{(s)} \text{ (rhombic)} \rightarrow CS_{2(l)}; \quad \Delta H = +106 \text{ kJ}$$

In this reaction 106 kJ of heat are absorbed (the reaction is endothermic). ↑ HEAT OF REACTION

LD005 heat of solution (*n.*) The heat change when 1 mole of a substance dissolves in such a large volume of solvent that an addition of more solvent produces no further heat of dilution. ↑ HEAT OF REACTION

LD006 heat of neutralization (*n.*) The heat evolved when one mole of a given acid or base is completely neutralized. In reactions between strong acids and strong bases there is complete dissociation into ions and the neutralization reaction is between one mole of hydrogen ions (H^+) and one mole of hydroxide ions (OH^-), *i.e.*

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}; \quad \Delta H = -57{\cdot}3 \text{ kJ}$$

For week acids or bases, the heat of neutralization is less than −57·3 kJ, showing that the acid or base is not completely dissociated into ions in solution ↑ HEAT OF REACTION

LD007 thermochemical equation (*n.*) An

equation which gives information about the states and energy relations in a chemical reaction or change. It is a molar equation. $C_{(s)} + 2S_{(s)} \rightarrow CS_{2(l)}$; $\Delta H = +105{\cdot}7$ kJ. A reaction which starts with 1 mole of solid graphite and 2 moles of solid sulphur under suitable conditions ends with 1 mole of liquid carbon disulphide. 105·7 kJ of energy are absorbed, *i.e.* there is a change of enthalpy of +105·7 kJ. The enthalpy of $CS_{2(l)}$ is +105·7 kJ. ↓ ENTHALPY ↑ THERMOCHEMISTRY

LD008 enthalpy (*n.*) This is:

internal energy + (pressure × volume).

It is often defined as the heat energy content of a system. By convention elements are said to have zero enthalpy. The enthalpy of a compound is numerically equal to the heat given out or taken in when one mole of a compound is formed from its elements (in their standard states) at constant pressure, *e.g.* $C_{(s)}$ graphite + $2S_{(s)} \rightarrow CS_{2(l)}$;

$\Delta H = +106$ kJ

i.e. the enthalpy of the compound CS_2 is greater by 106 kJ than that of either the carbon or sulphur. This value is also called the heat of formation of carbon disulphide. This reaction takes place at constant pressure. The term also applies to more complex systems of reactants and products, *e.g.*

$$HBr_{(g)} + C_2H_{4(g)} \rightarrow C_2H_5Br_{(l)}$$

↑ THERMOCHEMICAL EQUATION → INTERNAL ENERGY

LD009 Hess's law (*n.*) The law that no matter how a chemical change takes place, the total heat change for the process is the same, *e.g.* to form ammonium chloride solution:

$NH_{3(g)} + aq \rightarrow NH_{3(aq)}$ $\Delta H = -35{\cdot}2$ kJ

$HCl_{(g)} + aq \rightarrow HCl_{(aq)}$ $\Delta H = -72{\cdot}4$ kJ

add the two solutions,

$NH_{3(aq)} + HCl_{(aq)} \rightarrow NH_4Cl_{(aq)}$ $\Delta H = -52{\cdot}3$ kJ

for the overall reaction,

$\Delta H = (-35{\cdot}2) + (-72{\cdot}4) + (-52{\cdot}3)$ kJ
$= -159{\cdot}9$ kJ

or,

$HCl_{(g)} + NH_{3(g)} \rightarrow NH_4Cl_{(s)}$ $\Delta H = -176{\cdot}1$ kJ

$NH_4Cl_{(s)} + aq \rightarrow NH_4Cl_{(aq)}$ $\Delta H = +16{\cdot}3$ kJ

for the overall reaction,

$\Delta H = (-176{\cdot}1) + 16{\cdot}3$ kJ
$= -159{\cdot}8$ kJ

↑ THERMOCHEMISTRY

LD010 exothermic (*adj.*) An exothermic reaction (change) is one in which heat energy is evolved, *i.e.* there is a rise of temperature in the surroundings. This means that the system has lost enthalpy and the change in energy is shown as ΔH negative, *e.g.*

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_3$; $\Delta H = -92$ kJ

Ammonia is said to be an exothermic compound, *i.e.* heat is evolved on its formation. —***exothermically*** (*adv.*) ↓ ENDOTHERMIC (Cn) ↑ THERMOCHEMISTRY

LD011 endothermic (*adj.*) An endothermic reaction (change) is one in which heat energy is absorbed, *i.e.* there is a fall in temperature in the surroundings. This means that the system has gained enthalpy and the change in energy is shown as ΔH positive.

$C_{(s)} + 2S_{(s)} \rightarrow CS_{2(l)}$; $\Delta H = +106$ kJ

Carbon disulphide is said to be an endothermic compound, *i.e.* heat is absorbed on its formation. —***endothermically*** (*adv.*) ↑ EXOTHERMIC (Cn)

LD012 thermodynamics (*n.sing.*) The study of the relationships between heat and other forms of energy (chemical energy, electrical energy, etc.) and the ways in which one form of energy can be converted into another and work can be done. It is used in the study of chemical reactions, electric cells, heat engines, and many other branches of physics and engineering. It is based on experimental **laws of thermodynamics** and is concerned with matter in the mass; it is not dependent on any atomic or molecular theory. Note that **dynamics** is a branch of mechanics dealing with the action of forces; it does not concern itself with temperature but with energy transfer as work. **Thermodynamics** involves temperature changes as well, *i.e.* the transfer of energy as heat. —***thermodynamic*** (*adj.*) ↓ SYSTEM[2] · STATE[2] · INTERNAL ENERGY · FREE ENERGY · ENTROPY ↑ CHEMICAL ENERGY · ENTHALPY

LD013 system[2] (*n.*) A chemical reaction or a chemical change, taking place in a particular region of space, as investigated in an experiment. ↓ SPECIFIC HEAT CAPACITY OF A GAS · MOLAR HEAT OF FUSION · MOLAR HEAT OF VAPORIZATION ↑ THERMODYNAMICS

LD014 1st law of thermodynamics (*n.*) The law that states that when energy of one form disappears, an equivalent amount of energy appears in some other form. ↓ 2ND LAW OF THERMODYNAMICS · SPECIFIC HEAT CAPACITY OF A GAS · MOLAR HEAT OF FUSION · MOLAR HEAT OF VAPORIZATION

LD015 2nd law of thermodynamics The law that states that a perfectly reversible process is the most efficient of all processes and produces the maximum amount of work for a given amount of heat. The law may also be stated as being that heat cannot be converted into work unless some of the heat is transferred from a higher to a lower temperature. ↑ 1ST LAW OF THERMODYNAMICS

LD016 specific heat capacity of a gas (*n.*) For a gas there are two values for specific heat capacity. The specific heat capacity at constant pressure c_p and the specific heat capacity at constant volume c_V. The ratio of these c_p/c_V is always greater than 1. Its value is an important indication of the atomicity of the gas (symbol γ). If $c_p/c_V = 1{\cdot}66$ the gas is monatomic. ↓ MOLAR HEAT OF FUSION → ATOMICITY

LD017 molar heat of fusion (*n.*) The heat energy needed to change 1 mole of a solid to the liquid state at the melting point, *e.g.* $H_2O_{(s)} \rightarrow H_2O_{(l)}$; $\Delta H = +5{\cdot}8$ kJ per mole. ↑ 1ST LAW OF THERMODYNAMICS

LD018 molar heat of vaporization (*n.*) The

heat energy needed to change 1 mole of liquid to the vapour state at the boiling point, *e.g.*
$H_2O_{(l)} \rightarrow H_2O_{(g)}$; $\Delta H = +40{\cdot}3$ kJ per mole
↑ SYSTEM[2]

LD019 state[2] (*n.*) The state of a system is what is specified when the system is described. The state of a mole of gas can be specified by giving the values of only two of the properties of pressure, volume, or temperature □ *initial state; final state* ↓ EQUATION OF STATE · STATE FUNCTION ↑ THERMODYNAMICS

LD020 equation of state (*n.*) An equation that shows the relation between the pressure, volume, and temperature of a substance. For an ideal gas the equation of state is $pV = nRT$. For solids, liquids, and non-ideal gases the equation will be more complex. ↑ STATE[2]

LD021 state function (*n.*) Any quantity (macroscopic) which can be used to specify the state of a thermodynamic system. Pressure, volume, temperature, and enthalpy, are all examples of state functions. If enough state functions are known the state of the system is completely specified, *e.g.* if the pressure and volume of a mole of gas are known, the other properties (temperature, enthalpy, etc.) are also fixed. State functions depend only on the state of a system, not on the way that state was reached. Thus in any change of a system the total changes in pressure, temperature, etc., depend only on the initial and final states, and not on the path followed during the change. ↑ STATE[2]

LD022 internal energy (*n.*) The energy which a system possesses. This energy depends upon the internal state of the system as determined by its pressure, temperature, and composition. The kinetic energy of motion of individual molecules or ions, the kinetic energy and potential energy of electrons and other particles within individual molecules or ions, contribute to the internal energy of the system. Work and heat are means of getting energy in and out of the system and so of changing the internal energy. It can be said that a change of internal energy (U) is equal to the heat (q) added to the system, less the work done (W) by the system: $U = q - W$. Internal energy is related to enthalpy (symbol H) as shown in the equation $U = H - pV$. ↓ FREE ENERGY · ENTROPY ↑ THERMODYNAMICS · ENTHALPY

LD023 intrinsic energy (*n.*) The total energy of a substance. The sum of the different types of energy translation, rotational, vibrational, and electronic energy. It is symbolized U. ↑ INTERNAL ENERGY

LD024 free energy (*n.*) The energy free to do work in a given system. In chemistry the Gibbs free energy (or Gibbs function) is usually used; this is the free energy for changes at constant pressure and is defined by the equation $G = H - TS$, where H is the enthalpy, T the temperature, and S the entropy. ↑ INTERNAL ENERGY → CHEMICAL POTENTIAL

LD025 entropy (*n.*) A measure of the amount of disorder in a system; the more disordered the system, the higher the entropy. The disorder may be molecular chaos, *e.g.* when a liquid changes to a gas at the same temperature the entropy increases because the gas molecules are more disordered than the liquid molecules. Similarly a mixture of two gases has a higher entropy than the two separate gases. An entropy change occurs when a system absorbs or evolves heat; the change in entropy is measured as the heat change divided by the temperature at which the change takes place; thus $dS = dq/T$, where dS is the entropy change. The entropy of a perfect crystal of each element or compound is given a reference value of zero at absolute zero of temperature. ↑ INTERNAL ENERGY

Metabolism

MA001 metabolism (*n.*) The chemical processes which take place in a living organism, or within part of a living organism, are collectively known as metabolism. Metabolism consists of **catabolism** and **anabolism**. —METABOLITE (*n.*) METABOLIZE (*v.*) ***metabolic*** (*adj.*) ↕ METABOLITE · CATABOLISM (H) · ANABOLISM (H) · BASAL METABOLISM · METABOLIZE · GLYCOLYSIS · KREBS CYCLE · ENZYME · LIVER · NUTRITION · RESPIRATION

MA002 metabolite (*n.*) A substance which takes part in a metabolic process. Those metabolites which the organism cannot manufacture have to be obtained from the environment; some metabolites are supplied partly by the environment and partly by the organism; the majority of the metabolites in an organism are manufactured by the organism, *e.g.* ***a*** nitrate ions are metabolites taken in by most plants from the environment; ***b*** Vitamin D is a metabolite of human beings which is partly taken in from the environment and partly manufactured during metabolism. ↓ CATABOLISM · ANABOLISM ↑ METABOLISM

MA003 catabolism (*n.*) The decomposition of chemical substances within an organism; the substances are usually complex organic substances, the products are simpler organic substances, and the process is usually accompanied by a release of energy. The catabolism of substrates, such as carbohydrates, proteins, etc., shows great similarity

in all organisms, particularly in the use of enzymes catalysing the successive stages of the catabolic process. —***catabolic*** (*adj.*)
↓ ANABOLISM (An) ↑ METABOLITE → ENZYME

MA004 anabolism (*n.*) The synthesis of complex organic compounds from simpler organic compounds, *e.g.* the synthesis of proteins from amino acids. The process requires energy, mainly supplied in the form of ATP. —***anabolic*** (*adj.*) ↑ METABOLITE · CATABOLISM (An) → ATP

MA005 basal metabolism (*n.*) The metabolism of an animal at rest and not eating, *i.e.* the rate of expenditure of energy; usually expressed in joules per kilogramme weight of the animal per hour.
↓ BASAL METABOLIC RATE · BMR ↑ METABOLISM

MA006 basal metabolic rate (*n.*) The basal metabolism of man, expressed in joules per m^2 of body area per hour. The rate is measured from the mass of oxygen consumed or the mass of carbon dioxide given off.
↑ BASAL METABOLISM

MA007 BMR (*abbr.*) Abbreviation for BASAL METABOLIC RATE. ↑ BASAL METABOLISM

MA008 metabolize (*v.t.*) To decompose, or synthesize, a compound by metabolism.
↑ METABOLISM

MA009 glycolysis (*n.*) A process consisting of a sequence of nine chemical reactions, during which glucose is converted to pyruvic acid; the process occurs in plants, animals, and bacteria. The reactions are catalysed by various enzymes and coenzymes, and the process is anaerobic. For each molecule of glucose, two molecules of pyruvic acid are formed, and the chemical energy released in these catabolic reactions is stored in ATP. The amount of ATP formed by glycolysis is small compared with the amount formed by the Krebs cycle. Glycolysis is the first stage in tissue respiration and fermentation and in the release of energy in mammalian muscle.
↓ FERMENTATION · OXYGEN DEBT · PYRUVIC ACID · KREBS CYCLE[1] ↑ METABOLISM → TISSUE RESPIRATION

MA010 fermentation (*n.*) An anaerobic process of decomposition of carbohydrates, carried out by bacteria and yeasts. In alcoholic fermentation a carbohydrate is first hydrolysed by enzyme action to glucose, glycolysis follows, and pyruvic acid, formed by glycolysis, is decarboxylated, releasing carbon dioxide, and is reduced to ethanol. This is a form of anaerobic respiration, and provides energy for the organism. The amount of energy released is only about one third of that released from the complete oxidation of glucose to carbon dioxide and water. Besides ethanol, other compounds can be formed, such as acetone (propanone), propionic acid, ethanoic and methanoic (acetic and formic) acids, these are ketonic and acid fermentations. —***ferment*** (*v.*) ***fermenting*** (*adj.*) ↓ LACTIC ACID FERMENTATION · PUTREFACTION (H) · DECAY[2] · OXYGEN DEBT ↑ GLYCOLYSIS

MA011 lactic acid fermentation (*n.*) A form of glycolysis, characteristic of mammalian muscle; pyruvic acid is formed, as in glycolysis, and is then reduced to lactic acid by coenzyme action. The process is rapid, and provides energy for rapid muscular contraction. Lactic acid bacteria excrete lactic acid in their fermentation process.

$$\underset{\text{(pyruvic acid)}}{CH_3.CO.COOH} + NADH_2 \rightarrow \underset{\text{(lactic acid)}}{CH_3.CHOH.COOH} + NAD$$

↓ OXYGEN DEBT ↑ FERMENTATION

MA012 putrefaction (*n.*) The fermentation of proteins by bacteria, involving the anaerobic decomposition of the protein into carbon dioxide, and products such as hydrogen sulphide and malodorous amines derived from the amino acids in the protein. —***putrid*** (*adj.*) ***putrefy*** (*v.*) ↑ FERMENTATION

MA013 decay[2] (*n.*) The aerobic decomposition of organic substances of living organisms, leading to the liberation of carbon dioxide, water, and ammonia. —***decay*** (*v.*) ***decaying*** (*adj.*) ↑ FERMENTATION

MA014 oxygen debt (*n.*) The excess of oxygen consumed over the amount of oxygen supplied to a vertebrate striped muscle during action. Glycolysis releases energy at a fast rate for use by the muscle, and lactic acid is a product of this process. The oxygen consumption of the vertebrate remains above normal until the lactic acid has been oxidized, and the state of the muscle returned to normal. ↑ FERMENTATION → STRIPED MUSCLE

MA015 pyruvic acid (*n.*) A key compound in metabolism. All carbohydrates are first hydrolysed to glucose and then reduced to pyruvic acid by glycolysis. Similarly, some of the products of fat and protein metabolism are reduced to pyruvic acid. In aerobic tissue respiration, pyruvic acid enters the Krebs cycle; in anaerobic respiration, pyruvic acid can be converted to any of the products of fermentation. The formula of pyruvic acid is $CH_3.CO.COOH$, *i.e.* a 3-carbon compound ↑ GLYCOLYSIS

MA016 Krebs cycle (*n.*) A cyclic sequence of chemical reactions in which pyruvic acid is oxidized aerobically to carbon dioxide and water. Pyruvic acid is converted by a coenzyme to citric acid and enters the cycle. There are nine reactions in the cycle, a continuous process during which hydrogen is removed at four of the reactions, and combines with molecular oxygen to form water. Carbon dioxide is produced in two of the reactions. For each complete cycle, 12 molecules of ATP are formed, so the Krebs cycle provides most of the energy for biological work. The cycle occurs in all aerobic organisms, and is the final stage of the oxidation of complex organic compounds; the reactions mainly take place in, and are catalysed by enzyme systems of, the mitochondria in cells. The overall oxidative reaction for pyruvic acid is:

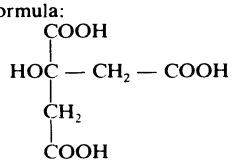
$$2CH_3.CO.COOH + 5O_2 \rightarrow 6CO_2 + 4H_2O$$

↓ CITRIC ACID CYCLE · CITRIC ACID

↑ METABOLISM → COENZYME · MITOCHONDRION · ATP

MA017 citric acid cycle (*n.*) Alternative term for KREBS CYCLE (↑).

MA018 citric acid (*n.*) An important compound in aerobic metabolism. Citric acid has the formula:



i.e. it is a 6-carbon compound.

The acid is formed from oxalacetic acid and an acetyl group (CH_3—CO—). In the Krebs cycle, citric acid is successively oxidized to a 5-carbon and a 4-carbon compound, with the release of two molecules of carbon dioxide. The 4-carbon compound is successively reduced to oxalacetic acid. Oxalacetic acid is also formed by the addition of carbon dioxide to pyruvic acid. In this way, pyruvic acid continually enters the cyclic process of citric acid – 5-carbon compound – 4-carbon compound – oxalacetic acid – citric acid (the Krebs cycle). ↑ KREB'S CYCLE

MA019 enzyme (*n.*) A protein which is produced by a living cell and which acts as a catalyst in biochemical changes. There are many different types of enzymes, some of which promote a narrow range of chemical reactions on chemically related substances, while most others promote one single chemical reaction. Most of the chemical reactions included in metabolism are dependent on enzymes to promote them at the required rate of reaction, otherwise at the temperature of and under the conditions in living organisms, the reaction would not occur perceptibly. The enzyme is not consumed in the reaction it promotes; a very small quantity of an enzyme is sufficient to convert a large quantity of a substrate. Each enzyme has optimum conditions for its action. *e.g.* temperature about 35°C.–40°C.; a specific pH for each enzyme; the presence of a coenzyme for some reactions; the absence of inhibiting substances. Many enzymes are inactivated, or destroyed, by temperatures above 50°C, and all are unstable compounds, readily destroyed by a large range of chemical substances. The name of a specific enzyme is very often derived from the name of the substrate on which it acts, *e.g.* maltose (substrate), maltase (enzyme); Sucrose (substrate), sucrase (enzyme); protein (a family of chemically related substrates), protease (a family of chemically related enzymes) □ *maltase promotes the conversion of maltose to glucose; sucrase acts on sucrose to form glucose and fructose* —***enzymolysis*** (*n.*) ***enzymatic, enzymolytic*** (*adj.*) ↓ FERMENT · ENZYMOLYSIS · SPECIFICITY · HYDROLYTIC · ZYMOLYSIS · COENZYME · ZYMOGEN · KINASE · AMYLASE · PEPTIDASE · ESTERASE ↑ METABOLISM → CATALYST (Sn) · NUTRITION

MA020 ferment (*n.*) An alternative term for ENZYME, little used in modern texts. ↓ ZYMIN · SUBSTRATE · ADAPTIVE ENZYME · CONSTITUTIVE ENZYME · INTRACELLULAR ENZYMES ↑ ENZYME

MA021 zymin (*n.*) An alternative term for ENZYME. ↑ FERMENT

MA022 substrate (*n.*) **1** A substance on which an enzyme acts to form an end product, *e.g.* maltase (an enzyme) acts on maltose (a substrate) to form glucose (an end product). **2** Material in which a micro-organism is inoculated, or is growing, *e.g.* ***a*** a culture medium (substrate) is inoculated with bacteria (micro-organism); ***b*** a fungus (micro-organism) grows on the skin (substrate) of a fruit. ↑ FERMENT → CULTURE[1] · NUTRIENT (Sn)

MA023 adaptive enzyme (*n.*) An enzyme produced by an organism only in response to the presence of a substrate, or a chemically-similar substance, on which the enzyme acts. This type of enzyme is particularly noticeable in bacteria. ↑ FERMENT

MA024 constitutive enzyme (*n.*) An enzyme produced by an organism without having to be induced by the presence of the substrate or chemically similar substance. ↑ FERMENT

MA025 intracellular enzymes (*n.pl.*) Those enzymes catalysing reactions that take place in cells. They include the enzymes contained in lysosomes, and the respiratory enzymes in mitochondria. ↑ FERMENT → MITOCHONDRION · LYSOSOME · POLYMERASE

MA026 enzymolysis (*n.*) A chemical change catalysed by an enzyme. ↑ ENZYME

MA027 specificity (*n.*) The characteristic of many enzymes of acting on one substrate only, *e.g.* lactase hydrolyses lactose only; lactase is **specific** for lactose. A specific enzyme is frequently named by the ending **-ase** joined with the name of the substrate, *e.g.* sucrose – sucrase, fumaric acid – fumarase. ↓ ACTIVE CENTRE · PHOSPHORYLATION ↑ ENZYME

MA028 active centre (*n.*) (In an enzyme molecule) the part that combines with the substrate; the active centre is generally only a small part of the enzyme molecule. ↑ SPECIFICITY

MA029 phosphorylation (*n.*) A biochemical reaction in which an organic substrate, such as a sugar, is combined with a phosphate ion by enzyme reaction. The phosphorylation of some organic substances produces high-energy bonds in the product, *e.g.* A.T.P.; these products are highly reactive under enzyme activation. During such reactions the phosphate ion is transferred from the product to another substance, and energy is released for biochemical and biological work. ↑ SPECIFICITY → ATP

MA030 hydrolytic (*adj.*) Describes an enzyme which catalyses the hydrolysis of a substrate. ↓ ENZYMOLYTIC ↑ ENZYME → AMYLOLYTIC (H) · PROTEOLYTIC (H) · LIPOLYTIC (H)

MA031 enzymolytic (*adj.*) Describes the reaction of enzymolysis, *e.g.* the digestion of food takes place through a series of enzymolytic reactions. ↑ HYDROLYTIC

MA032 zymolysis (*n.*) Decomposition of a substance brought about by enzymes. ↓ TRANSFERASE · DEHYDROGENASE · TRANSAMINASE · CATALASE ↑ ENZYME

MA033 transferase (*n.*) Any enzyme which catalyses a reaction in which a group of atoms, such as a radical, is transferred from a molecule of one substance to a molecule of another substance. ↓ ISOMERASE ↑ ZYMOLYSIS → TRANSAMINASE (H) · PHOSPHATASE (H) · RADICAL

MA034 isomerase (*adj.*) An enzyme which acts on a substrate to convert it to an isomer of the original substance. ↑ TRANSFERASE → ISOMER

MA035 dehydrogenase (*n.*) Any enzyme catalysing the oxidation of a substrate by the removal of hydrogen. The hydrogen may combine either with molecular oxygen or with another substance. In many cases a particular compound has a specific dehydrogenase, *e.g.* succinic dehydrogenase which oxidizes succinic acid only. ↓ OXIDASE (H) · PEROXIDASE (H) ↑ ZYMOLYSIS

MA036 oxidase (*n.*) A type of dehydrogenase; the hydrogen removed from the substrate combines with molecular oxygen. ↑ DEHYDROGENASE

MA037 peroxidase (*n.*) A dehydrogenase which removes hydrogen from a substrate and transfers it to hydrogen peroxide, reducing the latter to water, whilst oxidizing the substrate. Peroxidase occurs particularly in plants. ↑ DEHYDROGENASE

MA038 transaminase (*n.*) A transferase which catalyses the transferance of an amino group from a molecule of one substance to a molecule of another substance. ↓ PHOSPHATASE ↑ ZYMOLYSIS → AMINO GROUP · TRANSFERASE

MA039 phosphatase (*n.*) Any enzyme which splits off phosphate ions from organic phosphate esters; present in some animal tissues; abundant in osteoblasts and odontoblasts. An essential enzyme for the calcification of bones and teeth. ↑ TRANSAMINASE → OSTEOBLAST · ODONTOBLAST

MA040 catalase (*n.*) An enzyme found in plant and animal tissues; it decomposes hydrogen peroxide into molecular oxygen and water, thus protecting protoplasm from the toxic effects of hydrogen peroxide. ↓ UREASE · ZYMASE ↑ ZYMOLYSIS

MA041 urease (*n.*) An enzyme catalysing the hydrolysis of urea into ammonia and carbon dioxide; it occurs in the seeds of many plants and in many species of bacteria; it is rarely found in animals, except in a few invertebrates, *e.g.* crustaceans. ↑ CATALASE

MA042 zymase (*n.*) A group, or system of enzymes, which decomposes hexose sugars into ethanol and carbon dioxide; it occurs in yeasts. ↑ CATALASE

MA043 coenzyme (*n.*)An organic substance produced by living cells; it activates an enzyme, or accelerates the action of an enzyme, or takes part in a chain of enzyme reactions. In a chain of enzyme reactions, a coenzyme usually undergoes a chemical change of dissociation with one enzyme, and is reconstituted later in the chain of reactions by another enzyme. There are many coenzymes and some take part in chains of reactions catalysed by different systems, *e.g.* NAD and NADP. ↓ NAD · ATP · POLYMERASE · CHOLINESTERASE ↑ ENZYME → KINASE

MA044 NAD (*abbr.*) Nicotinamide adenine dinucleotide. A coenzyme taking part in redox reactions. It oxidizes substrates by removing hydrogen and is itself reduced, forming $NADH_2$. The reduced form reduces substrates and is itself oxidized to reconstitute NAD. This cyclical process is of fundamental importance and the ratio of NAD to $NADH_2$ in a cell plays an important part in controlling the rate of energy production. ↓ NADP ↑ COENZYME

MA045 NADP (*abbr.*) Nicotinamide adenine dinucleotide phosphate. A coenzyme taking part in redox reactions. It oxidizes substrates by removing hydrogen and is itself changed to the reduced form $NADPH_2$. The reduced form reduces substrates and is itself oxidized to reconstitute NADP. ↑ NAD

MA046 ATP (*abbr.*) Adenosine triphosphate. A coenzyme of fundamental importance found in the cells of all organisms; it provides a means of storage of energy for many cellular activities. Cellular activities depend on energy available in chemical bonds; the oxidizable compounds in organisms, *e.g.* carbohydrates, amino acids, and carboxylic acids, have low-energy bonds not directly usable as energy sources. The terminal-phosphate bonds of ATP are high energy ones, and they release more energy on hydrolysis than the bonds of the oxidizable compounds in the cell. One of the terminal phosphate groups is transferred to another substance by the action of an enzyme, and energy is released for chemical synthesis, active transport, muscular contraction, etc., in the cell. The ATP is hydrolysed to ADP in the reaction. ATP is then regenerated from ADP. ↓ ADP · PHOSPHAGEN ↑ COENZYME · PHOSPHORYLATION

MA047 ADP (*abbr.*) Adenosine diphosphate. A coenzyme of fundamental importance which combines with inorganic phosphate ions, obtaining energy for the reaction from either light energy in photosynthesis, or energy released in catabolic processes, or from phosphagen; the product is ATP. When a certain amount of energy is available in a cell as a result of glucose oxidation or photosynthesis, then one molecule of ATP is formed from ADP and a phosphate ion. It forms a method of stockpiling the energy released. ↑ ATP

MA048 phosphagen (*n.*) A compound

occurring in animal muscle: in vertebrate muscle it is creatine phosphate; in the muscles of some invertebrates it is arginine phosphate, and in other animals both phosphagens occur. The phosphate splits off from the phosphagen to provide energy and phosphate ions for the synthesis of ATP from ADP. Energy is obtained from metabolic reactions, *e.g.* glycogen decomposing to lactic acid, for the resynthesis of the phosphagen from inorganic phosphate ions and either creatine or arginine. ↑ ATP

MA049 polymerase (*n.*) An enzyme found in the nucleus of all cells; it catalyses the replication of DNA, resulting in one molecule of DNA forming two exact replicas of itself. ↓ TRANSCRIPTASE · RIBONUCLEASE ↑ COENZYME → DNA · REPLICATION

MA050 transcriptase (*n.*) An enzyme found in the nucleus of all cells; it catalyses the synthesis of a molecule of RNA from part of one strand of a molecule of DNA. ↑ POLYMERASE → DNA · RNA

MA051 ribonuclease (*n.*) An enzyme found in all cells; it breaks up a molecule of RNA into its constituent nucleotides. ↑ POLYMERASE

MA052 cholinesterase (*n.*) An enzyme destroying acetylcholine by hydrolysing it to choline and acetic acid after it has performed its function. ↑ COENZYME → ACETYLCHOLINE

MA053 zymogen (*n.*) An inactive substance, usually a protein, which can be transformed by a chemical change into an enzyme, *e.g.* prothrombin is a zymogen; when acted upon by thrombokinase, it is transformed into thrombin (an enzyme). —ZYMOGENIC (*adj.*) ↓ PRO-ENZYME · PEPSINOGEN · ZYMOGENIC · KINASE ↑ ENZYME

MA054 pro-enzyme (*n.*) An alternative term for ZYMOGEN. ↓ ZYMOGENESIS ↑ ZYMOGEN

MA055 zymogenesis (*n.*) The transformation of a zymogen into an enzyme, when the catalysing agent is a kinase. ↑ PRO-ENZYME

MA056 pepsinogen (*n.*) A zymogen secreted by glands in the gastric mucosa of vertebrates. It is activated by hydrochloric acid to form pepsin. ↓ TRYPSINOGEN ↑ ZYMOGEN → PEPSIN

MA057 trypsinogen (*n.*) A zymogen, transformed into trypsin by enterokinase, with trypsin already present. It is a compound of trypsin and a polypeptide and is secreted by the walls of the small intestine. ↑ PEPSINOGEN → TRYPSIN

MA058 zymogenic (*adj.*) **1** Of or to do with zymogens. **2** Describes a gland or bacterium that produces an enzyme. ↑ ZYMOGEN

MA059 kinase (*n.*) A substance which transforms a zymogen into an enzyme. A kinase is itself an enzyme. ↓ ZYMO-EXCITOR · ENTEROKINASE ↑ ENZYME → COENZYME

MA060 zymo-excitor (*n.*) A substance which activates a zymogen, transforming it into an enzyme. A zymo-excitor is not an enzyme, but usually a simpler chemical compound, *e.g.* hydrochloric acid activates pepsinogen to form pepsin. Compare a kinase, which is an enzyme. ↑ KINASE

MA061 enterokinase (*n.*) A kinase which transforms trypsinogen into trypsin; it requires the presence of some trypsin already formed for its action. ↑ KINASE

MA062 amylase (*n.*) Any enzyme which hydrolyses starch or glycogen; the products are dextrin or maltose. ↓ PTYALIN · PECTASE · AMYLOLYTIC ↑ ENZYME → STARCH · GLYCOGEN · DEXTRIN

MA063 ptyalin (*n.*) (In some mammals, including man) an amylase present in saliva. ↓ AMYLOPSIN · SUCRASE · INVERTASE · SACCHARASE · MALTASE · LACTASE · CELLULASE ↑ AMYLASE

MA064 amylopsin (*n.*) An amylase secreted in the pancreas of vertebrates. ↑ PTYALIN

MA065 sucrase (*n.*) An enzyme hydrolysing sucrose to glucose and fructose. ↑ PTYALIN

MA066 invertase (*n.*) Alternative term for SUCRASE. ↑ PTYALIN

MA067 saccharase (*n.*) Alternative term for SUCRASE. ↑ PTYALIN

MA068 maltase (*n.*) An enzyme hydrolysing maltose to glucose. ↑ PTYALIN

MA069 lactase (*n.*) An enzyme hydrolysing lactose to glucose and galactose. ↑ PTYALIN

MA070 cellulase (*n.*) An enzyme that hydrolyses cellulose to simpler carbohydrates; it occurs in bacteria and fungi, and in the gut of certain insects. ↑ PTYALIN

MA071 pectase (*n.*) An enzyme that converts insoluble pectic compounds to soluble pectins; it occurs in many plants. ↑ AMYLASE

MA072 amylolytic (*adj.*) Describes an enzyme which hydrolyses starch or glycogen to dextrin or maltose. ↑ AMYLASE → PROTEOLYTIC · LIPOLYTIC

MA073 peptidase (*n.*) Any enzyme which decomposes proteins or polypeptide chains by the hydrolysis of peptide links. ↓ EXOPEPTIDASE (H) · ENDOPEPTIDASE (H) · RENNIN · CATHEPSIN · PROTEOLYTIC ↑ ENZYME

MA074 exopeptidase (*n.*) Any enzyme which decomposes a peptide chain by removing terminal amino acids. ↓ ENDOPEPTIDASE · PROTEINASE ↑ PEPTIDASE

MA075 endopeptidase (*n.*) Any enzyme which decomposes a peptide chain by attacking the peptide links between certain amino acids, irrespective of where these amino acids occur in the peptide chain, *e.g.* pepsin, trypsin. ↑ EXOPEPTIDASE

MA076 proteinase (*n.*) A term often used to describe an endopeptidase when it decomposes a protein. ↑ EXOPEPTIDASE

MA077 rennin (*n.*) (In young mammals) an enzyme secreted in the stomach; it converts the soluble caseinogen of milk into casein, which in turn forms an insoluble compound of calcium and casein. Milk is clotted by rennin. ↓ PEPSIN · TRYPSIN · CHYMOTRYPSIN · EREPSIN ↑ PEPTIDASE

MA078 pepsin (*n.*) A peptidase formed in

the stomach of vertebrates by the action of hydrochloric acid on pepsinogen. ↑ RENNIN · PEPSINOGEN

MA079 trypsin (*n.*) A peptidase which hydrolyses proteins and polypeptides in creted as trypsinogen by the pancreas and acts upon food in the small intestine. ↑ RENNIN · TRYPSINOGEN

MA080 chymotrypsin (*n.*) An enzyme which acts in the small intestine to further hydrolyse the products of hydrolysis by pepsin and trypsin. ↑ RENNIN

MA081 erepsin (*n.*) A mixture of enzymes secreted in the small intestine of vertebrates; it completes the hydrolysis of proteins and polypeptides to amino acids. ↑ RENNIN

MA082 cathepsin (*n.*) A system of enzymes occuring in lysosomes in cells; it decomposes proteins and polypeptides and is responsible for autolysis. ↑ PEPTIDASE → AUTOLYSIS · LYSOSOME

MA083 proteolytic (*adj.*) Describes an enzyme which hydrolyses proteins to polypeptide chains, or polypeptide chains to amino acids. ↑ PEPTIDASE · AMYLOLYTIC ↓ LIPOLYTIC

MA084 esterase (*n.*) Any enzyme which catalyses the hydrolysis of an ester to form an alcohol and an organic acid; the term includes the enzymes which hydrolyse fats. ↓ LIPASE · LIPOLYTIC ↑ ENZYME

MA085 lipase (*n.*) An enzyme which hydrolyses true fats, *i.e.* esters of fatty acids, into an alcohol and fatty acids; it occurs in many animal organs and in vertebrate blood; also found in various plants and in various seeds. ↓ STEAPSIN ↑ ESTERASE

MA086 steapsin (*n.*) An enzyme in the pancreatic juice of vertebrates; it hydrolyses true fats to an alcohol and fatty acids. ↑ LIPASE

MA087 lipolytic (*adj.*) **1** Describes an enzyme which hydrolyses true fats to an alcohol and fatty acids. **2** Describes a substance capable of dissolving fat. ↑ ESTERASE → AMYLOLYTIC · PROTEOLYTIC

MA088 liver (*n.*) A large, exocrine, gland, with a duct opening into the gut; the term is usually applied to the vertebrate organ, but digestive glands of invertebrates are also known as the liver. The organ is not homologous in the different animal phyla; its evolutionary origin is associated with enzymes for digestion. The vertebrate liver has many functions associated with general metabolism, *e.g.* production of bile; deamination of amino acids; detoxication; storage of carbohydrate, mineral ions, vitamins; osmoregulation of blood plasma; digestion of lipids, production of plasma colloids The metabolic activity produces heat which keeps the body warm. In mammals, the liver has irregularly shaped lobes. ↓ LOBULE · DEAMINATION · GLYCOGEN · DETOXICATION · HEPATITIS · HEPATIC · BILE · PANCREAS ↑ METABOLISM

MA089 lobule (*n.*) An approximately hexagonal-shaped columnar structure found in the liver; it is composed of liver cells and bounded by a membrane of connective tissue. Each lobe of a liver is composed of lobules. Each lobule is composed of chains of liver cells radiating from the centre; these chains of liver cells are called trabeculae. At the centre of the lobule is a tributary of the hepatic vein. At a corner of a lobule is a Gleeson's capsule. ↓ GLEESON'S CAPSULE · HEPATIC SINUSOIDS ↑ LIVER

MA090 Gleeson's capsule (*n.*) A tube of fibrous connective tissue containing branches of the hepatic portal vein and hepatic artery, and a bile channel. The vein and the artery supply blood to the liver; the portal vein brings absorbed products of digestion from the intestines; the bile channel collects bile from the lobule. ↑ LOBULE

MA091 hepatic sinusoids (*n.pl.*) One of the two minute channels which lie between the trabeculae of liver cells. They conduct blood from the branches of the hepatic artery and the hepatic portal vein (in a Gleeson's capsule) past the liver cells. Various metabolic processes take place, and the blood is finally delivered to a tributary of the hepatic vein in a lobule. Blood flows from the periphery to the centre of a lobule. ↑ LOBULE → BILE CANALICULUS · SINUSOID

MA092 deamination (*n.*) A process involving the removal of an amino group ($-NH_2$) from an amino acid, forming ammonia and a non-nitrogenous residue. The common process is oxidative deamination, an enzymatic reaction:

$$\underset{\text{alanine}}{CH_3.CHNH_2.COOH} + (O) \rightarrow \underset{\text{ammonia}}{NH_3} + \underset{\text{pyruvic acid}}{CH_3COCOOH}$$

The ammonia is excreted as, ***a*** urea; ***b*** uric acid; or ***c*** ammonia, in the lower forms of aquatic life. The non-nitrogenous residue can be either transaminated to an amino acid, or converted to glucose, or enter the Krebs cycle. In vertebrates, the process takes place in the liver and the products are removed by the blood stream or used in the liver. In invertebrates, the process frequently takes place in the excretory organs. —***deaminate*** (*v.*) ↓ UREA · URIC ACID · ORNITHINE CYCLE · ORNITHINE ↑ LIVER → AMINO ACID[2]

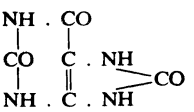
MA093 urea (*n.*) In ureotelic vertebrates, and in some invertebrates, ammonia is converted to urea by the action of carbon dioxide; the overall process is:

$$CO_2 + 2NH_3 \rightarrow \underset{\text{urea}}{CO(NH_2)_2} + H_2O$$

Urea is an excretory end-product of protein metabolism; it is eliminated in solution from the body by excretory organs as it is readily soluble in water. Urea also occurs in plants. ↑ DEAMINATION

MA094 uric acid (*n.*) A complex organic compound, an end-product of deamination

and breakdown of nucleic acids; its formula is:



It belongs to the group of compounds called purines. Uric acid is the main excretory product of uricotelic vertebrates and of some invertebrates; in these animals it is the end-product of both deamination and the breakdown of nucleic acids. Uric acid is also excreted by primates, but not by other mammals, as an end-product of the breakdown of nucleic acids. Uric acid is only sparingly soluble in water. ↑ DEAMINATION → NUCLEIC ACID · URICOTELIC

MA095 ornithine cycle (*n.*) (In ureotelic vertebrates) a cyclic reaction for the formation of urea; it takes place in the liver. The two reactions of the cycle are,

a ornithine + carbon dioxide + ammonia → arginine

b arginine → ornithine + urea

The second reaction is activated by the enzyme arginase. ↑ DEAMINATION

MA096 ornithine (*n.*) An amino acid found in the faecal pellets of birds. ↑ DEAMINATION

MA097 glycogen (*n.*) A soluble polysaccharide, a polymer of glucose, formed by animals and by fungi, used to store carbohydrate in the organism. It is animal starch. In vertebrates, glycogen is manufactured and stored mostly in the liver, but also in voluntary muscles. In the liver, the manufacture and breakdown of glycogen is controlled by hormones. ↓ GLYCOGENESIS · GLYCOGENOLYSIS ↑ LIVER → STARCH · INSULIN · GLUCAGON

MA098 glycogenesis (*n.*) The formation of glycogen from the absorbed products of digestion. Carbohydrates are digested to glucose, and glucose polymerized to glycogen. The liver can also convert amino acids and fats to carbohydrates, and then convert the carbohydrates to glycogen. Glycogenesis is stimulated by insulin. ↓ GLYCOGENOLYSIS (Cn) ↑ GLYCOGEN

MA099 glycogenolysis (*n.*) The breakdown in the liver of glycogen to glucose, glycogenolysis is stimulated by glucagon or adrenalin. ↑ GLYCOGENESIS (Cn) · GLYCOGEN

MA100 detoxication (*n.*) **1** The inhibition of the effects of toxins or poisons by chemical action to synthesize a comparatively harmless product. The liver is the main site of detoxication in vertebrates. **2** The same process, but by the action of antitoxins formed by blood proteins. ↓ TRANSAMINATION ↑ LIVER

MA101 transamination (*n.*) A process involving the transfer of an amino group from an amino acid to another substance, the reaction being catalysed by a transaminase, such as:

$$C_3H_7.CHNH_2.COOH + CH_3COCOOH$$
valine pyruvic acid

$$\rightarrow CH_3CHNH_2.COOH + C_3H_7.CO.COOH$$
alanine

A different amino acid and a non-nitrogenous product are formed. In vertebrates, the process takes place in the liver, and one amino acid is converted to another; this allows the balance of amino acids, peculiar to any organism, to be maintained. ↑ DETOXICATION

MA102 hepatitis (*n.*) Inflammation of the liver. ↓ INFECTIVE HEPATITIS ↑ LIVER

MA103 infective hepatitis (*n.*) A disease caused by a water-borne virus, which attacks liver cells, causing malfunctioning of the liver; it eventually damages the liver. ↑ HEPATITIS

MA104 hepatic (*adj.*) Of, or to do with, the liver. ↑ LIVER

MA105 bile (*n.*) (In vertebrates) a secretion of the liver; it is a bitter, slightly alkaline liquid, yellowish-green to golden-brown in colour, consisting of bile salts, bile pigments and other substances dissolved in water. Its function is to assist in the digestion of fat (see BILE SALTS (↓)) and to act as a vehicle for the rejection of toxic or poisonous substances. —BILIARY, BILIOUS (*adj.*) ↓ GALL · BILE CANALICULUS · GALL-BLADDER · JAUNDICE[2] · BILIARY ↑ LIVER

MA106 gall (*n.*) Alternative term for BILE. ↓ BILE SALTS · BILE PIGMENTS · BILIRUBIN ↑ BILE

MA107 bile salts (*n.pl.*) These are sodium taurocholate and sodium glycocholate, manufactured by the liver; they are responsible for the alkaline reaction and bitter taste of bile. Their function is to lower the surface tension of chyme and emulsify the fats, preparing the fats for digestion by enzymes. ↑ GALL

MA108 bile pigments (*n.pl.*) These are excretory products of the liver, derived from haemoglobin of worn-out red blood cells; they colour faeces. ↑ GALL

MA109 bilirubin (*n.*) A reddish-yellow bile pigment, also found in blood; it is the end-product of haemoglobin metabolism. ↑ GALL → UROBILINOGEN

MA110 bile canaliculus (*n.,pl.* **bile canaliculi**) One of the two minute channels which lie between the trabeculae of liver cells. The liver cells secrete bile which drains into a canaliculus. The canaliculus conducts the bile to a tributary of a bile channel in a Gleeson's capsule. Bile flows from the centre to the periphery of a lobule; it flows in the opposite direction to blood in the hepatic sinusoids. ↓ BILE CHANNEL · HEPATIC DUCT ↓ BILE → GLEESON'S CAPSULE · HEPATIC SINUSOIDS

MA111 bile channel (*n.*) One of the channels which begin as tributaries in Gleeson's capsules and join together to form larger ducts – tributaries of the hepatic ducts. They are sometimes called bile ducts, but the term is better applied to the final duct leading to the duodenum. ↑ BILE CANALICULUS → BILE DUCT

MA112 hepatic duct (*n.*) A right and a left hepatic duct leave the liver and join to form a common hepatic duct. The hepatic duct is joined by the cystic duct, and then becomes the bile duct. The hepatic duct conducts bile to the gall-bladder and duodenum. ↑ BILE CANALICULUS

MA113 gall-bladder (*n.*) (In many vertebrates) a small bladder situated between the lobes of the liver; it is connected to the liver through the cystic duct and the hepatic duct. Its function is to store bile, and its capacity in man is 30–50 cm^3. The liver secretes bile continuously, but the bile only enters the duodenum during periods of digestion, otherwise the liquid is stored in the gall-bladder. The walls are contractile, and empty the gall-bladder when food, especially fat, passes through the duodenum. The contractions are probably activated by a hormone secreted by the intestinal walls. ↓ CYSTIC DUCT · BILE DUCT ↑ BILE

MA114 cystic duct (*n.*) A duct connecting the hepatic duct to the gall-bladder. ↑ GALL-BLADDER

MA115 bile duct (*n.*) The duct which conducts bile from the hepatic and cystic ducts to the duodenum; it is joined at its distal end to the pancreatic duct. ↑ GALL-BLADDER

MA116 jaundice[2] (*n.*) A sign of certain diseases, usually associated with malfunctioning of the liver. Bile is present in the blood and the bile pigments give the skin, the eyes, and urine, a deep yellow colour. ↓ OBSTRUCTIVE JAUNDICE · GALLSTONE ↑ BILE

MA117 obstructive jaundice (*n.*) The condition in which the bile duct, the cystic duct, or the hepatic duct, becomes blocked, causing bile to be absorbed into the blood, resulting in jaundice. ↑ JAUNDICE[2]

MA118 gallstone (*n.*) A hard stone formed in the gall-bladder; it contains cholesterol combined with other substances. ↑ JAUNDICE[2]

MA119 biliary (*adj.*) Of, to do with, or conducting, bile, *e.g.* a biliary duct. ↓ BILIOUS ↑ BILE

MA120 bilious (*adj.*) Producing too much bile with resulting gastric disturbances. ↑ BILIARY

MA121 pancreas (*n.*) A compound racemose gland supported by mesentery and situated in the loop of the duodenum of gnathostome vertebrates. It secretes pancreatic juice when stimulated by the hormone secretin. It also contains groups of cells, the Islets of Langerhans, of different structure and function. The production of pancreatic juice is an exocrine function, while the Islets of Langerhans are endocrine glands. —PANCREATIC (*adj.*) ↓ SWEETBREAD · BLOOD-SUGAR[1] · INSULIN · DIABETES · PANCREATIC ↑ LIVER → ENDOCRINE · EXOCRINE

MA122 sweetbread (*n.*) Alternative term for PANCREAS (↑). ↓ ISLETS OF LANGERHANS · PANCREATIC DUCT

MA123 Islets of Langerhans (*n.pl.*) (In gnathostome vertebrates) groups of cells scattered throughout the pancreas; they comprise endocrine glandular tissue secreting insulin and glucagon. ↑ SWEETBREAD → INSULIN

MA124 pancreatic duct (*n.*) The duct leading from the pancreas to the duodenum; it is joined by the bile duct before entering the duodenum. ↑ SWEETBREAD · BILE DUCT

MA125 blood-sugar[1] (*n.*) Glucose dissolved in blood plasma. In mammals, the concentration of glucose is maintained at a fairly constant level; in man the limits of concentration are 0·8–1·8 mg cm^{-3}. The concentration is maintained by the liver under hormone control; insulin reduces the concentration, glucagon and adrenalin increase the concentration. ↓ HYPOGLYCAEMIA · HYPERGLYCAEMIA ↑ PANCREAS

MA126 hypoglycaemia (*n.*) A condition in which the concentration of glucose in the blood is too low; somatic cells are starved of glucose and brain-cells are damaged. ↑ BLOOD-SUGAR[1]

MA127 hyperglycaemia (*n.*) A condition in which the concentration of glucose in the blood is too high; it arises from a deficiency of insulin and is associated with diabetes mellitus; glucose is excreted in the urine. ↑ BLOOD-SUGAR[1]

MA128 insulin (*n.*) A hormone secreted by the Islets of Langerhans; secretion of the hormone is stimulated by a high concentration of glucose in the blood. Insulin suppresses the release of glucose from glycogen in the liver; it increases the formation of glycogen from glucose in voluntary muscle and in the liver. Insulin is antagonistic to glucagon and adrenalin. ↓ GLUCAGON ↑ PANCREAS → HORMONE

MA129 glucagon (*n.*) (In gnathostome vertebrates) a hormone secreted by the Islets of Langerhans; secretion of the hormone is stimulated by a low concentration of glucose in the blood. The hormone stimulates the breakdown of glycogen to glucose, and thus releases glucose into the blood stream. Its action is similar to that of adrenalin and antagonistic to that of insulin. ↑ INSULIN

MA130 diabetes (*n.*) A general term for a disease which is accompanied by an excessive production and passing of urine. —***diabetic*** (*adj.*) ↓ DIABETES MELLITUS · DIABETES INSIPIDUS ↑ PANCREAS

MA131 diabetes mellitus (*n.*) Disease caused by the malfunctioning of the Islets of Langerhans, resulting in an insufficient production of insulin. This causes hyperglycaemia and the presence of glucose in urine. Thirst is a symptom of the disease, as a large quantity of water is needed to form the large quantity of urine needed to excrete

the excess glucose. The disease causes a serious loss in weight of the body, and eventually can cause death. ↑ DIABETES

MA132 diabetes insipidus (*n.*) Disease caused by malfunctioning of the pituitary gland. The characteristic symptom is the passing of large quantities of urine; the urine is very dilute, and contains no glucose (compare diabetes mellitus). Excessive thirst is caused by the loss of liquid in the urine. The disease is chronic but not fatal. ↑ DIABETES

MA133 pancreatic (*adj.*) Of, or to do with, the pancreas. ↑ PANCREAS

Nutrition

MB001 nutrition (*n.*) The replacement of the cellular material broken down in respiration and of the material used up in the growth of an organism. The particular chemical form of materials used in nutrition varies from one group of organisms to another; types of nutrition are described in general terms according to, ***a*** oxidizable materials used in metabolism; ***b*** the type of energy source. —NUTRIENT, NUTRIMENT (*n.*) NUTRITIOUS, NUTRITIVE, NUTRITIONAL (*adj.*) ↓ NUTRIENT · DEBRIS · HERBIVORE · AUTOPHYTE · NOURISH · NUTRITIOUS · HOLOPHYTIC · PHOTOTROPHIC → PHOTOSYNTHESIS · PROTEIN · MOUTH · GUT · DIGESTION · DIET · METABOLISM

MB002 nutrient (*n.*) A substance or compound that can be used in the nutrition of a specific organism, *e.g.* ***a*** inorganic salts in soil are nutrients for plants; ***b*** starch is a nutrient for man. ↓ NUTRIMENT · NOURISHMENT · SUSTENANCE ↑ NUTRITION

MB003 nutriment (*n.*) A collection of nutrients used by an organism in its nutrition. ↑ NUTRIENT

MB004 nourishment (*n.*) Materials, substances, or compounds, which keep a cell, tissue, organ, or organism, functioning properly, *e.g.* tissues and organs obtain nourishment from the blood of a higher organism. For organisms, **nourishment** and **nutriment** are almost the same in meaning, but nourishment implies essential nutriment to maintain the life of the organism, whereas nutriment is restricted to usefulness in nutrition, and alone may not maintain life; pure carbohydrates are nutriment for rats, but they are inadequate as nourishment. ↑ NUTRIENT

MB005 sustenance (*n.*) Food in any form given to support life in an organism. The focus is on the agent providing the sustenance, *e.g.* a mother provides sustenance for a foetus. Contrast **nourishment** and **sustenance**: in nourishment the focus is on the recipient, *e.g.* the foetus obtains nourishment from its mother. ↑ NUTRIENT

MB006 debris (*n.*) Fragments formed from material which has been broken, *e.g.* organic debris consists of fragments of cell or tissue material, no longer living, formed by the breaking up of dead organisms. Organic debris provides nutriment for many microscopic animals and for larger ones such as sponges. ↓ BORER ↑ NUTRITION

MB007 borer (*n.*) Any invertebrate which bores through wood or other hard tissue and usually takes in the material for food, *e.g.* the stem-borer; woodworm. ↑ DEBRIS

MB008 herbivore (*n.*) An animal that eats plants. In herbivorous mammals, the caecum and vermiform appendix are large and in them the cellulose walls of plants are broken down into fatty acids by symbiotic bacteria. —***herbivorous*** (*adj.*) ↓ RUMINANT · CARNIVORE · OMNIVORE ↑ NUTRITION

MB009 ruminant (*n.*) A herbivorous mammal which possesses usually four, but sometimes only three, chambers in its stomach. Newly ingested food is passed to the first chamber without chewing. ↑ HERBIVORE → RUMEN

MB010 carnivore (*n.*) An animal that eats flesh. In carnivorous mammals, the caecum is very small and usually vestigial. —***carnivorous*** (*adj.*) ↑ HERBIVORE

MB011 omnivore (*n.*) An animal that eats both plants and flesh. —***omnivorous*** (*adj.*) ↑ HERBIVORE

MB012 autophyte (*n.*) A plant obtaining its nutrients solely from inorganic substances, *i.e.* self-nourished. An autophyte is a primary producer. —AUTOPHYTIC (*adj.*) ↑ NUTRITION → PRIMARY PRODUCTIVITY

MB013 nourish (*v.t.*) To supply a cell, tissue, organ or organism, with essential materials or substances, to allow it to function properly, or in the case of an organism, to keep it alive. —***nourishing*** (*adj.*) NOURISHMENT (*n.*) ↑ NUTRITION

MB014 nutritious (*adj.*) **1** Describes a nutrient Starch is nutritious for herbivores, *i.e.* starch is a nutrient for herbivores, or starch can be used as a nutrient by herbivores. **2** (G.S.) Efficient as a food, *e.g.* beef stew is nutritious, *i.e.* all the beef stew is usable as food; there is no waste and it supplies the needs of the body, such as vitamins and mineral salts □ *lean meat is highly nutritious* ↓ NUTRITIVE · NUTRITIONAL ↑ NUTRITION

MB015 nutritive (*adj.*) Concerned with the function of nutrition, *e.g.* the nutritive cells of *Hydra* are those which absorb digested food ↑ NUTRITIOUS

MB016 nutritional (*adj.*) Concerned or to do with nutrition, *e.g.* ***a*** there are definite nutritional types of organisms, *i.e.*

organisms can be classified into different groups according to their nutrition; ***b*** the nutritional requirements of flesh-eating animals are different from those of plant-eating animals. Constrast **nutritive** and **nutritious** with **nutritional**, ***a*** the stomach is a nutritive organ of a vertebrate (its function); ***b*** cellulose has no nutritive value for human beings (it has no value for the function of nutrition); ***c*** protein is nutritious for carnivores (it is a nutrient); ***d*** the nutritional requirements of man include protein (a requirement concerned with nutrition). ↑ NUTRITIOUS

MB017 holophytic (*adj.*) Describes a mode of nutrition; it is applied to organisms which are able to synthesize complex organic substances from simple inorganic substances, such as carbon dioxide, water, nitrate ions, phosphate ions, etc., with light as the source of energy for synthesis, and to obtain nutrients in this way only, *e.g.* the mode of nutrition of green plants is holophytic — the nutrients are made by the process of photosynthesis ☐ *a tree is a holophytic organism; the nutrition of a tree is holophytic* ↓ HOLOZOIC · AUTOTROPHIC · HETEROTROPHIC · SAPROPHAGOUS · SAPROZOIC · NECTARIVOROUS · AUTOPHYTIC ↑ NUTRITION → SAPROPHYTIC · PARASITIC

MB018 holozoic (*adj.*) Describes a mode of nutrition; it is applied to an organism which ingests solid or liquid complex organic substances as nutrients. Animals are holozoic organisms; they do not possess the ability to synthesize complex organic substances from simple inorganic substances ☐ *human beings are holozoic organisms* ↓ CHEMOTROPHIC ↑ HOLOPHYTIC

MB019 autotrophic (*adj.*) Describes a mode of nutrition; it is applied to organisms which do not depend on the environment for a source of organic substances as nutrients. Most green plants and some species of bacteria are autotrophic; they manufacture complex organic substances from simple inorganic substances, such as carbon dioxide, water, nitrate ions, etc. Autotrophic organisms are holophytic if they are phototrophic; if they are chemotrophic, they are not holophytic ☐ *plants containing chlorophyll are autotrophic organisms* —***autotroph*** (*n.*) ↓ CHEMOTROPHIC ↑ HOLOPHYTIC (H) → METABOLITE

MB020 heterotrophic (*adj.*) Describes a mode of nutrition; it is applied to organisms which need a supply of organic substances from their environment to manufacture their own organic constituents. Heterotrophic organisms include all animals, all fungi, and most bacteria. Fungi absorb liquid organic substrates from their environment, but they do not ingest solid substances, so they are heterotrophic but not holozoic ☐ *yeasts, which are fungi, are heterotrophic organisms* ↑ HOLOPHYTIC

MB021 saprophagous (*adj.*) Describes an animal which feeds on dead or rotting organic material, *e.g.* a sponge is saprophagous. ↑ HOLOPHYTIC

MB022 saprozoic (*adj.*) Alternative term for SAPROPHAGOUS.

MB023 nectarivorous (*adj.*) Describes insects that sip nectar. ↑ HOLOPHYTIC

MB024 autophytic (*adj.*) Of, or to do with, an autophyte. An alternative term for AUTOTROPHIC. ↑ HOLOPHYTIC · AUTOTROPHIC (Sn)

MB025 phototrophic (*adj.*) Describes an organism which requires radiant energy for its cellular processes (or alternatively, an organism obtaining energy from sunlight), *e.g.* all green plants and some photosynthetic bacteria are phototrophic. ↓ CHEMOTROPHIC (I) · PHOTO-ORGANOTROPHIC (H) · PHOTOLITHOTROPHIC (H) · CHEMO-ORGANOTROPHIC · CHEMOLITHOTROPHIC ↑ NUTRITION

MB026 chemotrophic (*adj.*) Describes an organism which obtains energy by a series of oxidation-reduction reactions based on organic or inorganic substrates obtained from the environment, *e.g.* ***a*** most animals, fungi, and many bacteria, oxidize carbohydrates (organic substrates) to release energy; ***b*** some bacteria, such as *Nitrosomanas*, oxidize ammonia (an inorganic substrate) to nitrite ions using atmospheric oxygen. —***chemotroph*** (*n.*) ↑ PHOTOTROPHIC (I) → AEROBIC (H) · ANAEROBIC (H)

MB027 photo-organotrophic (*adj.*) Describes an organism which requires radiant energy and an oxidizable organic substrate to release energy for cellular activity. A few specialized bacteria, such as the non-sulphur bacteria, are in this nutritional group. —***photo-organotroph*** (*n.*) ↑ PHOTOTROPHIC

MB028 photolithotrophic (*adj.*) Describes an organism which requires radiant energy and oxidizable inorganic substrates to release energy for cellular activity, *e.g.* ***a*** all green plants are in this nutritional group; the oxidizable substrate is water; ***b*** some specialized bacteria, such as sulphur bacteria, use hydrogen sulphide (an inorganic substance) as the oxidizable substrate. —***photolithotroph*** (*n.*) ↑ PHOTOTROPHIC

MB029 chemo-organotrophic (*n.*) Describes an organism obtaining energy from oxidation-reduction reactions based on organic substances, *e.g.* most animals and the majority of micro-organisms are in this nutritional group. —***chemo-organotroph*** (*n.*) ↑ PHOTOTROPHIC → AEROBIC (H) · ANAEROBIC (H)

MB030 chemolithotrophic (*adj.*) Describes an organism obtaining energy from oxidation–reduction reactions based on inorganic substances. The only organisms in this nutritional group are specialized bacteria, *e.g.* ***a*** *Nitrobacter* oxidize nitrite ions to nitrate ions using atmospheric oxygen; ***b*** some species of hydrogen bacteria reduce nitrate ions to nitrogen using molecular hydrogen. —***chemolithotroph*** ↑ PHOTOTROPHIC → AEROBIC (H) · ANAEROBIC (H)

Photosynthesis

MC001 photosynthesis (*n.*) A process in green plants, in which complex organic compounds are synthesized from carbon dioxide and water using energy obtained from sunlight. Chlorophyll in the plant makes available the energy from the sun, and the reaction takes place, ***a*** in chloroplasts in all green plants, except blue-green algae, ***b*** in chromatophores in blue-green algae and photosynthetic bacteria. The overall reaction is

$$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6, + 6O_2,$$

but is better expressed as

$$6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O,$$

as water is formed during the process. The product is glucose or fructose and molecular oxygen. —***photosynthetic*** (*adj.*) ↓ CHLOROPHYLL · LIGHT REACTION · CHLOROTIC · CARTOTENOID → NUTRITION

MC002 chlorophyll (*n.*) The chlorophylls are complex organic compounds, each a characteristic green pigment; in structure they resemble the haem of haemoglobin, with magnesium (instead of iron) as the central atom. The characteristic chlorophylls of green plants are chlorophyll *a* and chlorophyll *b*, with minor differences of chemical structure. In blue-green algae, only chlorophyll *a* is found; in all other green plants, both chlorophylls are found. Chlorophyll *a* takes part in the cyclic phosphorylation process of the light reaction in photosynthesis; chlorophyll *b* takes part in the non-cyclic phosphorylation process. The principal region of light absorption by the chlorophylls is in the red part of the visible spectrum. ↓ BACTERIOCHLOROPHYLL · CHLOROSIS ↑ PHOTOSYNTHESIS

MC003 bacteriochlorophyll (*n.*) A photosynthetic pigment found in photosynthetic bacteria; the bacteriochlorophylls differ only in minor structural detail from chlorophylls *a* and *b*. The principal region of light absorption by these pigments is in the near infra-red spectrum. This permits photosynthetic bacteria to grow in places where green plants cannot live, *e.g.* on the surface of black muds. There are two forms of bacteriochlorophyll, each associated with a group of bacteria. ↑ CHLOROPHYLL

MC004 chlorosis (*n.*) A condition in green plants caused by failure of chlorophyll formation. Plant parts which are normally green become yellow. One cause is magnesium deficiency in the soil. ↑ CHLOROPHYLL

MC005 light reaction (*n.*) Light energy ionizes chlorophyll; the ejected electron is trapped by a series of substances acting as electron acceptors, and its energy is transformed to chemical energy by two different paths. In the first path, this is done by the formation of ATP molecules from ADP molecules. This is a cyclic phosphorylation process, as the ejected electron finally returns to the chlorophyll. In the second path, the ejected electron is replaced by the electron from a hydroxyl ion (OH^-) which is obtained by the ionization of water. This is a non-cyclic process, and by it a hydrogen atom is made available. Two hydroxyl groups (—OH) react to form water and oxygen.

$$4OH \rightarrow 2H_2O + O_2$$

↓ DARK REACTION · PHOTOLYSIS ↑ PHOTOSYNTHESIS

MC006 dark reaction (*n.*) This process receives energy, which is supplied by the ATP formed in the light reaction. Hydrogen atoms formed in the light reaction reduce carbon dioxide:

$$CO_2 + 4[H] \longrightarrow (CH_2O) + H_2O$$
$$6\,(CH_2O) \longrightarrow C_6H_{12}O_6$$

This synthesis is carried out by a cyclic series of chemical reactions. Carbon dioxide and hydrogen are added to the cycle, and a monosaccharide, either glucose or fructose, is formed. Fructose and glucose combine to form sucrose; the carbohydrate material of the plant is translocated, in the vascular system of the plant, as sucrose. Glucose polymerizes to form firstly maltose, and finally starch, the form in which carbohydrate is stored in the plant. The dark reaction takes place in the stroma of the chloroplasts. In photosynthetic bacteria, the hydroxyl groups are used as oxidizing agents, through acting as hydrogen acceptors to various substrates, *e.g.* sulphur bacteria use hydrogen sulphide, which is oxidized to sulphur:

$$2H_2S + 4\,(OH) \rightarrow 2S + 4H_2O$$

↑ LIGHT REACTION → CHLOROPLAST

MC007 photolysis (*n.*) Decomposition of a molecule by light energy – a concept used in the older theories of photosynthesis. —***photolytic*** (*adj.*) ↑ LIGHT REACTION

MC008 chlorotic (*adj.*) Describes the appearance of a plant suffering from chlorosis. ↑ PHOTOSYNTHESIS

MC009 carotenoid (*n.*) Any one of a group of yellow, orange, or red, pigments found in plants and animals. The carotenoids include the carotenes, the xanthophylls, and other fat-soluble pigments. They are found in all photosynthetic plants and in many non-photosynthetic plants. They occur in chloroplasts and plastids together with chlorophyll; they also occur in plant structures other than those associated with photosynthesis. The colour of carotenoids sometimes masks the green of chlorophyll, *e.g.* as in brown algae. In some organisms, the carotenoids absorb light and can transfer the energy to the chlorophyll; the light in regions of the visible spectrum other than the absorption region of chlorophyll can be used by carotenoids to provide energy for photosynthesis. In several species of bacteria, the carotenoid pigments

protect the bacterial cell from photochemical damage. —CAROTENOID (*adj.*) ↓ CAROTENE · PHYCOBILINS · PHOTOREVERSIBLE ↑ PHOTOSYNTHESIS

MC010 carotene (*n.*) Any one of a group of orange or red pigments; the pigments are synthesized by the plant and are found in chloroplasts, plastids and chromatophores, together with chlorophyll. They are also found in liver, certain natural oils and fats, egg yolk, etc., and impart colour to these tissues and materials. The liver secretes enzymes which activate the transformation of carotenes to vitamin A. ↓ XANTHOPHYLL · CAROTIN · CAROTINOID ↑ CAROTENOID

MC011 xanthophyll (*n.*) Any one of a group of yellow pigments found in plants, usually occurring with carotene. Xanthophylls are responsible for the colour of falling leaves of deciduous trees. ↑ CAROTENE

MC012 carotin (*n.*) Alternative term for CAROTENE (↑).

MC013 carotinoid (*n.*) Alternative term for CAROTENOID. ↑ CAROTENE · CAROTENOID

MC014 phycobilins (*n.pl.*) Pigments found in certain algae. Their action is similar to that of carotene, *i.e.* they absorb light energy and transfer it to chlorophyll for use in photosynthesis. The pigments are present in the chloroplasts of red algae and in the photosynthetic lamellae of blue-green algae. ↓ PHYCOCYANIN · PHYCOERYTHRIN · PHYTOCHROME · BILIPROTEINS ↑ CAROTENOID

MC015 phycocyanin (*n.*) A blue pigment; a phycobilin. ↑ PHYCOBILINS

MC016 phycoerythrin (*n.*) A red pigment; a phycobilin. ↑ PHYCOBILINS

MC017 phytochrome (*n.*) A protein-containing plant pigment, photoreversible in action and sensitive to red light (of wavelength about 660 nm), present only in low concentrations. The pigment is energized by light, becomes a chemically active form and functions as an enzyme to initiate growth reactions of plants. The growth reactions include germination; development of stem, root, and leaves; flowering; other pigment formation. These reactions are those associated with photoperiodism in the plant. After conversion to the activated form it is either gradually lost and reconverted, or reconverted without use, into the original inactive form. The reconversion takes place in darkness or more quickly in the presence of red light of a longer wavelength (about 730 nm). The relative amounts of light in these two regions of the spectrum determine the proportions of activated and inactive forms of phytochrome, and this in turn determines the response of the plant. ↓ PHOTOREVERSIBLE ↑ PHYCOBILINS

MC018 biliproteins (*n.pl.*) Alternative term for PHYCOBILINS (↑).

MC019 photoreversible (*adj.*) Describes a substance which takes in energy from light to become energized, but also can be deactivated by light, *i.e.* the wavelength of the light determines whether the substance is in an active or inactive form. ↑ CAROTENOID

Nutrients

MD001 protein (*n.*) A complex organic compound formed from many units of amino acids (hundreds or thousands of such units), joined by peptide bonds; a protein can also be considered as a chemical combination of several peptides. The protein molecule consists of one or more chains of atoms, usually folded or coiled in a complicated way. All proteins in plants and animals are formed from 22 different amino acids, 20 of which are commonly occurring and 2 are rare. In any one protein the sequence of amino acids in the chain is always the same. The possible combination of the 20 common amino acids is almost infinite and the different combinations give rise to the wide variety of proteins found in organisms. Proteins include enzymes, structural proteins (keratin, collagen, silk, etc.), respiratory proteins (haemoglobin, haemocyamin, etc.), blood proteins (albumin, globulin, fibrinogen, etc.), antibodies, toxic proteins (snake venom, fungal toxin), hormones, nucleoproteins (chromosomal protein), and other substances such as yolk proteins and lipoproteins. Proteins are not fat-soluble, but many are water-soluble or soluble in dilute saline solution, such as globulins. All proteins are synthesized from amino acids through a mechanism depending on nucleic acids. Only autotrophic organisms can manufacture amino acids; heterotrophic organisms must obtain amino acids for protein synthesis from digested protein. ↓ AMINO ACID[2] · GLOBULIN · FAT[2] · STEROID · STARCH → NUTRITION · ENZYME · HAEMOGLOBIN · ANTIBODY · HORMONE

MD002 amino acid[2] (*n.*) The naturally occurring amino acids are carboxylic acids with an amino group ($-NH_2$) attached to the carbon atom next to the carboxyl group. The general formula is $R.CH(NH_2)COOH$, where R is a variable grouping of atoms (a carbon chain or a carbon ring). Every organism maintains a supply of amino acids in a definite proportion of the 20 common and 2 rare amino acids, peculiar to each species of organism ↓ AMINO GROUP ↑ PROTEIN

MD003 amino group (*n.*) A group of atoms, consisting of one nitrogen atom and two hydrogen atoms, which remains unchanged in many organic reactions. The amino group

is represented in symbols as $—NH_2$. An amino group replaces a hydrogen atom attached to a carbon atom in an organic compound. ↑ AMINO ACID[2] → PEPTIDE BOND · AMINE

MD004 globulin (*n.*) Any one of a group of proteins which are insoluble in water but soluble in saline solution and are coagulated by heat. Globulins are present in many plant and animal tissues and liquids, *e.g.* haemoglobin and many of the proteins in plant seeds are globulins. ↓ ALBUMIN · VENOM

MD005 albumin (*n.*) A group of water-soluble proteins coagulated by heat, occurring in egg-white, blood serum, milk, and in other animal and plant tissues. ↑ GLOBULIN

MD006 venom (*n.*) A poison produced by an animal and injected by biting into other animals to kill or to incapacitate the victim. —***venomous*** (*adj.*) ↑ GLOBULIN

MD007 fat[2] (*n.*) **1** Any substance which can be extracted from tissues by ether, hot ethanol, or petrol (fat-solvents). This is a wide definition covering neutral fats, sterols, steroids, carotenes and terpenes. In this sense, lipids, lipins, and lipoids, are fats. **2** True fat or neutral fat, as considered in dietetics, is an ester of glycerol with one, two, or three different fatty acids replacing the three hydroxyl groups of the trihydric alcohol, glycerol. **3** Any substance which is a true fat and solid below 20°C; this is in contrast to an ***oil***. **4** Alternative term for ADIPOSE TISSUE. —FAT, FATTY (*adj.*) ↓ FATTY ACID · LIPID · OIL[2] · LIPOIDAEMIA · FATTY ↑ PROTEIN → CAROTENE

MD008 fatty acid (*n.*) A carboxylic acid containing an even number of carbon atoms in a straight chain. These acids can be divided into three groups, ***a*** saturated fatty acids with no double bonds; ***b*** unsaturated fatty acids with one or two double bonds; ***c*** polyunsaturated fatty acids with more than two double bonds. ↓ SATURATED FATTY ACIDS · UNSATURATED FATTY ACIDS · POLYUNSATURATED FATTY ACIDS · GLYCEROL · GLYCERIDE · GLYCERIN · ESSENTIAL FATTY ACIDS · EFA ↑ FAT[2]

MD009 saturated fatty acids (*n.pl.*) A fatty acid in which all the valencies of carbon are satisfied by single bonds. Biological fatty acids are usually straight chain compounds with an even number of carbon atoms. The common saturated fatty acids are:

lauric acid	$C_{11}H_{23}COOH$
myristic acid	$C_{13}H_{27}COOH$
palmitic acid	$C_{15}H_{31}COOH$
stearic acid	$C_{17}H_{35}COOH$

↑ FATTY ACID

MD010 unsaturated fatty acids (*n.pl.*) A fatty acid containing one or two double bonds. The most important of these is oleic acid, formula:

$$C_8H_{17}CH : CH\ C_7H_{14}COOH$$

i.e. $C_{17}H_{33}COOH$. It is the most widely distributed fatty acid in nature. Linoleic acid ($C_{17}H_{31}COOH$) is also important, as it is one of the three essential fatty acids (EFA) ↑ FATTY ACID

MD011 polyunsaturated fatty acids (*n.pl.*) A fatty acid containing more than two double bonds. Two of these are important, being two of the three essential fatty acids (EFA), namely linolenic acid ($C_{17}H_{29}COOH$) and arachidonic acid ($C_{19}H_{31}COOH$). ↑ FATTY ACID

MD012 glycerol (*n.*) A sweet, sticky liquid which is an alcohol with three hydroxyl groups; the formula is:

$$\begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array}$$

The three hydroxyl groups can be substituted with fatty acids or with any other organic acid to form various esters. ↑ FATTY ACID → ALCOHOL

MD013 glyceride (*n.*) An ester of glycerol, usually taken to be a neutral fat. ↑ FATTY ACID

MD014 glycerin, *or* **glycerine** (*n.*) (G.S.) Alternative term for GLYCEROL. ↑ FATTY ACID

MD015 essential fatty acids (EFA) (*n.pl.*) Arachidonic, linoleic, and linolenic acids. They act as precursors of substances biologically active in controlling blood pressure, smooth muscle contractions, and inducing synthesis of enzymes and hormones. They are essential for health; no deficiency in human beings has been recorded but deficiencies in laboratory animals have been observed. ↑ FATTY ACID

MD016 EFA (*abbr.*) Abbreviation for essential fatty acids. ↑ FATTY ACID

MD017 lipid, *or* **lipide** (*n.*) Any substance occurring in plants or animals with the property of solubility in ether, hot ethanol, and petrol. *i.e.* fat-solvents; the term includes true fats, waxes, sterols, steroids, phospholipids, etc. ↓ LIPIN · PHOSPHOLIPID ↑ FAT[2]

MD018 lipin, *or* **lipine** (*n.*) Any lipid containing nitrogen; it may contain phosphorus and sulphur as well. ↑ LIPID

MD019 phospholipid (*n.*) A complex organic compound derived from glycerol substituted with fatty acids, a phosphate group, and a nitrogen-containing group. A phospholipid is a polar compound and is commonly found in bimolecular layers in membranes of cells. ↑ LIPID

MD020 oil[2] (*n.*) **1** A neutral liquid, soluble in ether, hot ethanol and petrol, but not soluble in water, containing carbon and hydrogen, capable of combustion and having a marked viscosity. The main types of oils are, ***a*** essential oils; ***b*** fixed oils; ***c*** mineral oils. **2** A neutral fat, liquid below 20°C, is usually called an oil; it contains a higher proportion of unsaturated fatty acids than a solid fat. Edible oils are usually extracted from the seeds of plants, and are fixed oils. ↓ MINERAL OIL · FIXED OIL · ESSENTIAL OIL[2] · TERPENE ↑ FAT[2]

MD021 mineral oil (*n.*) An oil obtained from the ground, formed over a very long period of time from plant origins. Such oils are hydrocarbons, *e.g* the alkanes. ↑ OIL[2]

MD022 fixed oil (*n.*) One of a group of non-volatile oils occurring in plant tissues, usually in the seeds, *e.g.* coconut oil and maize oil. Such oils are used in the preparation of food, many being edible. The oils are esters of glycerol with a high proportion of unsaturated fatty acids. ↑ UNSATURATED FATTY ACIDS · OIL[2]

MD023 essential oil[2] (*n.*) One of a group of volatile oils occurring in plant tissues, especially in flowers; essential oils give a plant its characteristic odour. ↑ OIL[2]

MD024 terpene (*n.*) One of a number of unsaturated hydrocarbons, all isomeric, with a ring structure and formula $C_{10}H_{16}$; they are colourless liquids with an aromatic odour, occurring in the essential oils and resins of many plants, *e.g.* turpentine is a mixture of terpenes. ↑ OIL[2] → RESIN

MD025 lipoidaemia (*n.*) A pathological condition in which fats are present in the blood in abnormally large amounts. ↑ FAT[2]

MD026 fatty (*adj.*) Of or to do with fats, *e.g.* fatty acids are the acids obtained from fats. ↑ FAT[2]

MD027 steroid (*n.*) One of a number of complex hydrocarbons of similar chemical structure, present in plants and animals, with solubility the same as that of a lipid. The steroids differ greatly in biological nature and include: some toxins, bile acids, vitamins of the D group, hormones, some carcinogens. Chemically they are saturated hydrocarbons with 17 carbon atoms arranged in one 5-carbon ring and three 6-carbon rings, with all four rings joined together by sharing six carbon atoms; hydroxyl, and carboxylic groups and carbon chains, are attached to various carbon members of the rings. In the higher animals, most steroids appear to be synthesized from cholesterol. Sterols are not usually classed with steroids, although they have the same basic ring structure. ↓ STEROL ↑ PROTEIN

MD028 sterol (*n.*) One of a group of solid alcohols with the ring structure of a steroid; it can form an ester either with a fatty acid or with any other organic acid. The most important sterol in the higher mammals is cholesterol. ↓ CHOLESTEROL · ERGOSTEROL ↑ STEROID → ALCOHOL

MD029 cholesterol (*n.*) A white, wax-like sterol present in all animal tissues, but not found in plant tissues. In higher mammals it is present in blood and plays an important part in the transporting of fat, and in the production of hormones. All mammals can synthesize the compound. The molecular formula is $C_{27}H_{55}OH$. ↑ STEROL

MD030 ergosterol (*n.*) A sterol present in the tissues of many plants, but not found in animals. ↑ STEROL

MD031 starch (*n.*) The common carbohydrate, formula $(C_6H_{10}O_5)_n$, formed in green plants by photosynthesis and stored in seeds and food storage organs. It is found in the stroma of chloroplasts and in leucoplasts (colourless plastids), being formed in grains composed of concentric layers. Starch is an insoluble polysaccharide; it stains blue with iodine. ↓ SUGAR[2] · HEXOSE[2] · GLUCOSE · SUCROSE · FEHLING'S TEST ↑ PROTEIN → CARBOHYDRATE[2] · CHLOROPLAST · LEUCOPLAST · CELLULOSE · GLYCOGEN

MD032 sugar[2] (*n.*) A white, crystalline carbohydrate, soluble in water and sweet to the taste; a plant product of photosynthesis. Sugars are classified as **reducing** or **non-reducing**, according to their reaction with Fehling's solution, and also as **monosaccharides** or **disaccharides**, according to their structure. ↓ BLOOD SUGAR[2] · MONOSACCHARIDE[2] · DISACCHARIDE[2] · POLYSACCHARIDE[2] · DEXTRIN ↑ STARCH → PHOTOSYNTHESIS

MD033 blood-sugar[2] (*n.*) Glucose, when circulating in blood as the final product of digestion and absorption. In mammals, it is maintained at a fairly constant concentration. ↑ SUGAR[2] → HYPOGLYCAEMIA · INSULIN

MD034 monosaccharide[2] (*n.*) A simple sugar containing 3, 4, 5, or 6, carbon atoms; on decomposition the product does not have the properties of a sugar. It is a reducing sugar. ↑ SUGAR[2]

MD035 disaccharide[2] (*n.*) A sugar formed by the combination of two monosaccharides, *e.g.* sucrose ($C_{12}H_{22}O_{11}$). It can be decomposed into its constituent monosaccharides by hydrolysis. ↑ SUGAR[2] → HYDROLYSIS

MD036 polysaccharide[2] (*n.*) A carbohydrate formed by the combination of from hundreds to thousands of monosaccharides, *e.g.* starch is a polysaccharide and a starch molecule contains hundreds of glucose molecules chemically combined. A polysaccharide does not have the properties of a sugar, being insoluble in water and not tasting sweet. ↑ SUGAR[2] → GLYCOGEN · INSULIN

MD037 dextrin (*n.*) A polysaccharide which is an intermediate product in the hydrolysis of starch to glucose. It consists of a short chain of six to twelve molecules of glucose polymerized together. ↑ SUGAR[2]

MD038 hexose[2] (*n.*) A monosaccharide with six carbon atoms, formula $C_6H_{12}O_6$. Common hexoses include glucose, fructose, galactose, and mannose. ↓ PENTOSE[2] · TRIOSE ↑ STARCH

MD039 pentose[2] (*n.*) A monosaccharide with five carbon atoms, formula $C_5H_{10}O_5$. Common pentoses include ribose and deoxyribose, occurring in nucleic acids. ↑ HEXOSE[2] → NUCLEIC ACID

MD040 triose (*n.*) A monosaccharide with three carbon atoms. ↑ HEXOSE[2]

MD041 glucose (*n.*) A hexose, the first product of photosynthesis, widely distributed in plants. The decomposition of glucose to carbon dioxide and water is the major source of biological energy. Animals obtain glucose through digestion of carbohydrates and deamination of amino acids. Plants store glucose as starch, animals store glucose as glycogen. ↓ FRUCTOSE · GALACTOSE · DEXTROSE · LAEVULOSE ↑ STARCH

MD042 fructose (*n.*) A hexose, widely distributed in plants, particularly in fruits. ↑ GLUCOSE

MD043 galactose (*n.*) A hexose, commonly found in plant polysaccharides such as mucilages and pectins; it is combined with glucose in lactose. ↑ GLUCOSE

MD044 dextrose (*n.*) Alternative term for GLUCOSE (↑).

MD045 laevulose (*n.*) Alternative term for FRUCTOSE (↑). ↑ GLUCOSE

MD046 sucrose (*n.*) A non-reducing disaccharide with a molecule composed of one molecule of glucose combined with one molecule of fructose. It is cane-sugar, the common form of sugar; it is common in plants, but not commonly produced by animals. ↓ LACTOSE · MALTOSE ↑ STARCH → SUCRASE · INVERTASE

MD047 lactose (*n.*) A reducing disaccharide with a molecule composed of one molecule of glucose chemically combined with one molecule of galactose. It is found in mammalian milk. ↑ SUCROSE → LACTASE

MD048 maltose (*n.*) A reducing disaccharide with a molecule composed of two molecules of glucose chemically combined. It is formed by the hydrolysis of starch and occurs in germinating seeds and in digestion. ↑ SUCROSE → MALTASE

MD049 Fehling's test (*n.*) A test for reducing sugars, using Fehling's solution, which consists of copper (II) sulphate, sodium potassium tartrate and sodium hydroxide. When a reducing sugar is warmed with Fehling's solution, a red precipitate of copper (I) oxide is formed. All monosaccharides and some disaccharides are reducing sugars. ↑ STARCH

Mouth and Teeth

ME001 mouth (*n.*) The external opening through which food is taken into an animal. ↓ STOMADAEUM · LIP · GAPE[1,2] · ORAL · HYPOSTOMATOUS · BUCCAL CAVITY · TOOTH[1] · MOUTH PARTS · PHARYNX ↑ NUTRITION

ME002 stomodaeum (*n.*) **1** The invagination of the ectoderm of a coelomate forming the first portion of the gut. **2** (In embryos of higher animals) the place where the outer skin is folded in and eventually where the mouth develops. —***stomodaeal*** (*adj.*) ↓ CYTOSTOME · STOMIUM · OSTIUM[1] ↑ MOUTH → PROCTODAEUM (Cn)

ME003 cytostome (*n.*) The mouth of a one-celled animal. ↑ STOMODAEUM

ME004 stomium (*n.*) **1** A group of thin-walled cells in the wall of a sporangium of a fern (order of Filicales). **2** The mouth of a worm or mollusc. ↑ STOMODAEUM → SPORANGIUM

ME005 ostium[1] (*n.*, *pl.* **ostia**) **1** A large pore, or mouth-like opening. **2** (In sponges) any of the openings through which water is drawn into the body of the sponge. —OSTIAL, OSTIATE (*adj.*) ↑ STOMODAEUM → OSTIUM[2] · OSTIUM[3] · SPONGE

ME006 lip (*n.*) **1** One of the soft flexible folds of tissue round the mouth of an animal, especially in mammals where the lips are used to grasp the teats of the mammary glands and also to keep food in the mouth while it is masticated. **2** (G.S.) The edge of an orifice or cavity, or of the mouth of a vessel. —***lipped*** (*adj.*) ↓ PERISTOMIUM · PROSTOMIUM · HYPOSTOME · ORAL GROOVE ↑ MOUTH

ME007 peristomium (*n.*) The first complete segment of a segmented worm which encircles the mouth (or stomium). ↑ LIP

ME008 prostomium (*n.*) A bulbous process which fits into the mouth or stomium of a worm or mollusc and which closes the mouth. It is richly supplied with sense organs. ↑ LIP

ME009 hypostome (*n.*) A slight prominence, at the top of which is the mouth, and below which is the gut, or enteron, of a coelenterate, *e.g.* in *Hydra*, the hypostome is situated between the tentacles, with the mouth at its tip and the gut below it. ↑ LIP

ME010 oral groove A deep groove leading to the cytostome or mouth of a unicellular organism. ↑ LIP · CYTOSTOME

ME011 gape[2] (*n.*) The measure from the upper to the lower jaw of a vertebrate when the mouth is opened to its fullest extent. ↑ MOUTH

ME012 gape[1] (*v.i.*) To open the mouth to its fullest extent. —GAPE[2] (*n.*) ↓ YAWN (Sn) ↑ MOUTH

ME013 yawn (*v.i.*) To open the mouth widely and at the same time to inhale or exhale air through the mouth. —YAWN (*n.*) ↑ GAPE[1] (Sn)

ME014 oral (*adj.*) **1** Concerned with or connected with the mouth, by being externally near or on the same side as the mouth. **2** Describes the side of an animal on which the mouth is situated. ↓ ABORAL (Cn) · BUCCAL (Sn) · LABIAL · LABIATE ↑ MOUTH

ME015 aboral (*adj.*) Describes the side of an organism opposite to the oral side. ↑ ORAL (Cn)

ME016 buccal (*adj.*) Describes that which is near and inside the mouth. Contrast **buccal** and **oral**, ***a*** in buccal respiration, a frog takes in air and oxygen diffuses into the tissue inside the mouth; ***b*** the oral groove of a *Paramecium* is outside and leads to the mouth of the organism; ***c*** the oral side of a *Paramecium* is that side on which the mouth is situated. —***bucco-*** (*pre.*) ↓ BUCCAL CAVITY ↑ ORAL (Sn)

ME017 labial (*adj.*) Of the lips; near the

lips; on the same side as the lips. *e.g.* ***a*** labial palps are palps of the lips; ***b*** the labial side of a tooth is that side nearer to the lips; ***c*** labial teeth are those near the lips. —LABIATE (*adj.*) ↓ LINGUAL ↑ ORAL

ME018 labiate (*adj.*) Lip-like in form or structure, *i.e.* thicker at the edges than in the main part. ↑ ORAL

ME019 hypostomatous (*adj.*) Describes an animal having its mouth on the underside of its head or of its body, *e.g.* a dogfish. ↑ MOUTH

ME020 buccal cavity (*n.*) A hollow into which the mouth opens and which receives food. In higher animals it contains the teeth and the tongue. In mammals, the hard palate forms the roof of the buccal cavity. The buccal cavity lies between the mouth and the pharynx. Some animals, such as arthropods, do not possess a buccal cavity. ↓ JAW · PALATE · TONGUE · BEAK · SALIVATION · INGEST · LINGUAL ↑ MOUTH

ME021 jaw (*n.*) The hard, supporting tissue (bone or cartilage) which forms the upper and lower parts of the mouth of some animals, especially vertebrates. The main function of the jaws is gripping prey or food, or biting with the aid of teeth, for which purposes the bones of the jaw are articulated, *e.g.* the upper and lower jaws of human beings which provide the movement of teeth for biting. —JAW (*adj.*) ↓ SOCKET · GUM[2] · GINGIVA · QUADRATE · CHEEK[2] ↑ BUCCAL CAVITY

ME022 socket (*n.*) A cavity into which a solid structure fits exactly, either for support or for rotation, *e.g.* ***a*** the root of a tooth fits for support into a socket in the jawbone of a mammal; ***b*** the ball-shaped end of a long bone fits into a socket in a base of the body to form a ball-and-socket joint which allows rotation. ↑ JAW → ROOT[2]

ME023 gum[2] (*n.*) Alternative term for GINGIVA (↓).

ME024 gingiva (*n.,pl.* **gingivae**) (In mammals) the soft tissues surrounding the jawbone in which teeth are rooted in sockets in the bone. —***gingeval*** (*adj.*) ***gingivo-*** (*pre.*) GINGIVITIS (*n.*) ↑ JAW

ME025 quadrate (*n.*) (In vertebrates other than mammals) a cartilage bone at a posterior end of the upper jaw bone, attaching the upper jaw to the brain case and articulating with the lower jaw. In mammals, the quadrate becomes the incus. ↑ JAW → INCUS

ME026 cheek[2] (*n.*) The muscular wall of the buccal cavity, covered internally with mucuous membrane, containing the buccal glands. ↑ JAW

ME027 palate (*n.*) (In vertebrates) the roof of the mouth; in crocodiles and mammals, there is a false palate between the true palate and the buccal cavity. ↓ FALSE PALATE · HARD PALATE · SOFT PALATE · TONSILS · SALIVA ↑ BUCCAL CAVITY

ME028 false palate (*n.*) A horizontal partition found in crocodiles and mammals which separates the alimentary tract from the nasal tract. It is divided into two parts, ***a*** the **hard palate** which is the anterior or front portion formed from bone, forming a roof to the buccal cavity and separating the buccal cavity from the nasal cavities; ***b*** the **soft palate** which is the posterior or hind portion which has no bony support, and is a fleshy muscular boundary between the pharynx and the nasal cavities. —***palatine*** (*adj.*) ↓ TONSILS ↑ PALATE → PHARYNX

ME029 hard palate (*n.*) See FALSE PALATE. ↑ PALATE

ME030 soft palate (*n.*) See FALSE PALATE. ↑ PALATE

ME031 tonsils (*n.*) A mass of lymphoid tissue on either side at the back of the buccal cavity. The tonsils are at the entrance to the pharynx; their probable function is the destruction of pathogenic bacteria. —***tonsillar*** (*adj.*) ***tonsilitis*** (*n.*) ↑ PALATE

ME032 saliva (*n.*) A liquid secretion produced in the buccal cavity of mammals, or in the oesophagus or gullet of other animals. Its functions are, ***a*** physical – to dissolve food or to make it into a liquid pulp; ***b*** chemical – to provide digestive enzymes or to prevent the clotting of liquids, as in biting insects. —SALIVATION, SALIVANT (*n.*) ***salivary, salivous*** (*adj.*) SALIVATE (*v.*) ↑ PALATE → SALIVATION · SALIVARY · SALIVATE

ME033 tongue (*n.*) A mobile, muscular organ, attached normally posteriorly by a root to the floor of the buccal cavity of a vertebrate; its functions are, ***a*** to assist in the mastication of food; ***b*** to act as an instrument of taste; ***c*** (in man) to act as an organ of speech. ↓ LINGUAL PAPILLA · TASTE · TASTE BUD · RADULA · HYOID BONE ↑ BUCCAL CAVITY → LINGUAL

ME034 lingual papilla (*n.,pl.* **lingual papillae**) One of the many very small, rounded protuberances on the upper surface of the tongues of mammals. On some lingual papillae are sense organs and on others are taste-buds. Cats, and animals of the same family, possess cornified lingual papillae which form a rasping surface. ↑ TONGUE

ME035 taste (*n.*) A sensation by which vertebrates can distinguish between substances suitable for ingestion and those not suitable. There are four main stimuli; sweetness, sourness, bitterness and saltiness. Contrast **flavour**, which is a sensation experienced by the olfactory organs, and by which different foods, such as sour fruits, can be distinguished. When the olfactory organs fail to function, because of a cold (inflammation of the nasal membranes), food has taste but no flavour □ *sugar has a sweet taste* —***taste*** (*v.*) ↑ TONGUE → GUSTATORY

ME036 taste bud (*n.*) One of the receptor end-organs for the sensation of taste, consisting of a group of sensory cells and supporting cells in a small cavity with an opening to the exterior. A taste bud responds to one stimulus only, *i.e.* sweet-

ness, sourness, bitterness, saltiness. In mammals, taste buds are distributed in lingual papillae over the upper surface of the tongue; in other vertebrates, taste buds are distributed on the walls of the buccal cavity in addition. ↑ TONGUE → CHEMORECEPTOR

ME037 radula (*n.*) A tongue-like, horny strip, with small, horny, tooth-like structures forming a rasping surface, situated behind the mouth of molluscs and on the floor of the radula sac, which is the part of the gullet containing the radula. The radula moves backwards and forwards and rasps food against the horny roof of the radula sac; it breaks up food and passes it down the gullet. —***radulate*** (*adj.*) ↑ TONGUE

ME038 hyoid bone (*n.*) A U-shaped bone to which the base of the tongue is attached by a sheet of fibrous tissue. (**Hyoid** describes a U-shaped structure.) ↑ TONGUE

ME039 beak (*n.*) **1** The horny-sheathed pointed jaws of a bird. **2** Any growth of similar shape found in other animals or in plants. —***beaked*** (*adj.*) ↓ ROSTRUM · ROSTELLUM ↑ BUCCAL CAVITY

ME040 rostrum (*n.*) **1** The beak of a bird. **2** Any structure resembling a beak, either from its shape, or from its position on the head. —ROSTRAL, ***rostrate, rostriform*** (*adj.*) ↑ BEAK

ME041 rostellum (*n.*) A small, round protruberance on the head of cestodes, such as tapeworms, which in some species has hooks. ↑ BEAK

ME042 salivation (*n.*) The process of producing saliva, *e.g.* salivation is caused by the sight or smell of food. ↓ GINGIVITIS · TONSILITIS · PHARYNGITIS · SALIVANT ↑ BUCCAL CAVITY

ME043 gingivitis (*n.*) Inflammation of the gums. ↑ SALIVATION

ME044 tonsilitis (*n.*) Inflammation of the tonsils. ↑ SALIVATION

ME045 pharyngitis (*n.*) Inflammation of the pharynx. ↑ SALIVATION

ME046 salivant (*n.*) A substance causing or increasing the secretion of saliva. ↑ SALIVATION

ME047 ingest (*v.*) To take solid material into the body for use as food. A mouth or buccal cavity is not necessary for the action; an amoeboid organism, such as a white blood cell, ingests food material by enclosing it in pseudopodia.—***ingestion*** (*n.*) ↓ SALIVATE · MASTICATE · RUMINATE · PECK · DABBLE · ENGULF[2] ↑ BUCCAL CAVITY → EGEST (Cn)

ME048 salivate (*v.t.,i.*) **1** (*v.i.*) To secrete saliva into the buccal cavity (or mouth); of the vertebrates, only mammals salivate. **2** (*v.t.*) To moisten and thus soften a substance with saliva. ↑ INGEST

ME049 masticate (*v.t.,i.*) **1** To tear, crush or grind a solid into very small pieces in a liquid and to mix it thoroughly into a smooth pulp, *e.g.* ***a*** to masticate substances to form plastics; ***b*** to masticate raw rubber. **2** (Of mammalian teeth) to bite, chew and grind in order to break solid food into small pieces and to make it a smooth pulp by mixing it with saliva. —***mastication*** (*n.*) ***masticated*** (*adj.*) ↑ INGEST ↓ CHEW

ME050 ruminate (*v.i.*) To chew half-digested food brought back from the first stomach (rumen). Also to ***chew the cud.*** ↑ INGEST → CHEW · RUMEN

ME051 peck (*v.t.,i.*) **1** To strike with a beak. **2** To make a hole in a solid with a beak. ↑ INGEST → BITE

ME052 dabble (*v.i.*) (Of birds) to move the beak about in water, *e.g.* ducks dabble in muddy water and remove a beakful of water. ↑ INGEST

ME053 engulf[2] (*v.t.*) (Of Protozoa possessing pseudopodia) to close the pseudopodia round a solid object, *e.g.* white blood cells ingest bacteria by engulfing the bacteria with pseudopodia. —***engulfment*** (*n.*) ↑ INGEST

ME054 lingual (*adj.*) Concerned with the tongue; tongue-like; of or near to the tongue, *e.g.* a tooth has two sides, one towards the tongue and one towards the cheeks or lips. The side towards the tongue is the **lingual** side; the opposite side is the **labial** side of the tooth. ↓ SALIVARY · GUSTATORY · ROSTRAL ↑ BUCCAL CAVITY · TONGUE · LABIAL (Cn)

ME055 salivary (*adj.*) Concerned with salivation, *i.e.* producing saliva. ↑ LINGUAL · SALIVA → GLAND

ME056 gustatory (*adj.*) Of or to do with the sensation of taste and flavour, *e.g.* the tongue is a gustatory organ *or* the tongue is an organ of **gustation**. —***gustation*** (*n.*) ↑ LINGUAL

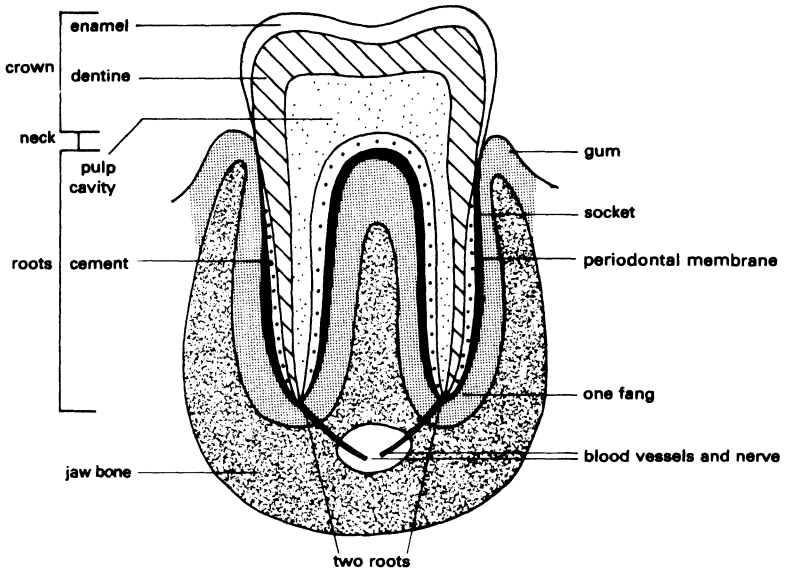
ME057 rostral (*adj.*) Beak-like; bluntly pointed, *e.g.* the rostral end of a finger. ↑ LINGUAL

ME058 tooth[1] (*n.,pl.* **teeth**) (In vertebrates) a small, hard structure which consists mainly of dentine, located in the buccal cavity. A tooth has a cutting edge that varies in shape depending upon its function. The structure of a tooth is similar to that of a denticle. The functions of vertebrate teeth are, ***a*** to seize prey; ***b*** to bite off portions of food; ***c*** to act as weapons of attack; ***d*** (in mammals only) to masticate food. —***toothed*** (*adj.*) ↓ TOOTH[2] · MILK TEETH · TUSK (H) · FANG (H) · DENTINE · INCISOR · CUSP · DENTITION · BITE · CHEW · DENTAL · HOMODONT · PERIODONTAL ↑ MOUTH

ME059 tooth[2] (*n.,pl.* **teeth**) Any small, pointed projection which resembles a tooth, *e.g.* the teeth of a cog-wheel. ↑ TOOTH[1] → COG-WHEEL

ME060 milk teeth (*n.pl.*) The first set of teeth of mammals consisting of some or all of the incisors, canines, and pre-molars Milk teeth are shed before puberty. Also called ***deciduous teeth***. ↓ PERMANENT TEETH · WISDOM TEETH · DECIDUOUS TEETH · CROWN · ROOT[2] · NECK · TUSK · FANG ↑ TOOTH[1] → THECODONT · DIPHYODENT

ME061 permanent teeth (*n.pl.*) The second set of teeth of mammals which erupt after the milk teeth have been shed. Permanent



TOOTH

teeth include the incisors, canines, premolars and molars □ *teeth erupt from the gums* ↑ MILK TEETH

ME062 wisdom teeth (*n.pl.*) The back four molars in man; the last permanent teeth to erupt, generally in the 17th year or later. In some individuals they never erupt. ↑ MILK TEETH

ME063 deciduous teeth (*n.pl.*) See MILK TEETH (↑).

ME064 crown (*n.*) **1** The top of an object, or of the head. **2** The exposed part of a tooth used for biting, or any similar action. ↑ MILK TEETH

ME065 root[2] (*n.*) **1** Any part of an organism which forms the base or support, or the growing point of a structure, *e.g.* the root of a fingernail from which the nail grows. **2** The part of the tooth of a mammal which is inserted in a socket in the jawbone. A mammalian tooth has either one, two, or three separate roots, each of which are also known as fangs. A root is described as open or closed, as described under **pulp cavity**. ↑ MILK TEETH ↓ PULP CAVITY

ME066 neck (*n.*) The slightly narrowed part of a tooth between the crown and the root, at the level of the gum. ↑ MILK TEETH

ME067 tusk (*n.*) A very long and generally curved tooth which projects outside the mouth and which generally occurs only in pairs, *e.g.* the tusks of an elephant. Tusks are either incisors or canines. —***tusked*** (*adj.*) ↑ MILK TEETH → MONODONT

ME068 fang (*n.*) **1** The root of a tooth, particularly one prong of the root. **2** A long, pointed tooth, particularly the venom tooth of a snake. ↑ MILK TEETH

ME069 dentine (*n.*) A hard, calcified, elastic, yellowish material of the same substance as bone but containing no cells; formed from the mesoderm of an embryo. Dentine is the main structural part of a tooth, *e.g.* ivory is dentine. ↓ ENAMEL · CEMENT · PULP[1] · PULP CAVITY · PERSISTENT PULP · PERIODONTAL MEMBRANE · ODONTOBLAST · ODONTOCLAST ↑ TOOTH[1]

ME070 enamel (*n.*) A hard, elastic, white material which contains no cells and which is almost completely inorganic substance; formed by the epithelium of the mouth. Enamel covers the crown of a tooth and covers a denticle. ↑ DENTINE → DENTICLE

ME071 cement (*n.*) A hard, bone-like substance covering the dentine of the root of a mammalian tooth; it is the inner of two layers of tissue connecting the root to the socket in the jawbone and is formed from mesodermal tissues. ↓ PERIODONTAL MEMBRANE ↑ DENTINE

ME072 pulp[1] (*n.*) **1** Any mass of plant or animal material which is soft, often spongy, and found inside a harder structure. **2** Dental pulp is the soft spongy mass of vascular tissue inside a tooth; on the outside it contains cells which form dentine, and which have processes penetrating the dentine. Dental pulp is formed from mesodermal tissue. **3** (G.S.) Any soft, almost liquid mass; any material crushed or broken up into a powder and softened by adding water, or by adding chemical sub-

stances. —PULP (*v.*) ***pulped*** (*adj.*) ↓ ODONTOBLAST ↑ DENTINE

ME073 pulp cavity (*n.*) The cavity inside the tooth of a vertebrate or inside a denticle. It is connected by a narrow channel to the tissues in which the tooth or denticle is embedded. In most teeth, and in all denticles, the channel narrows as the structure reaches full growth; such a tooth has a **closed root**, as opposed to an **open root**, *e.g.* human teeth have closed roots; once they reach maturity, the pulp is is no longer active in producing dentine. ↓ DENTICLE ↑ DENTINE

ME074 persistent pulp (*n.*) A pulp inside a tooth which remains active throughout life; the channel to the outside tissue does not become narrow and the tooth is continually growing by forming dentine, *e.g.* the incisors of a rabbit possess persistent pulps. Such a tooth has an **open root.** ↑ DENTINE

ME075 periodontal membrane (*n.*) A thin membrane of connective tissue surrounding the root of the tooth of a mammal; it is the outer of two layers of tissue connecting the root to the socket in the jawbone. ↑ DENTINE · CEMENT → PERIODONTAL

ME076 odontoblast (*n.*) A cell situated on the outer edge of the pulp of a tooth or denticle. The cell has processes penetrating the dentine and it forms dentine in growing teeth or denticles. ↑ DENTINE

ME077 odontoclast (*n.*) A multinucleate large cell which decomposes the calcified roots of milk teeth thus allowing the teeth to be shed. ↑ DENTINE

ME078 incisor (*n.*) A sharp chisel-shaped tooth of a mammal. It is used for biting, cutting, nibbling, gnawing or chewing; it has one root and is located at the front of the buccal cavity (or mouth). ↓ CANINE · PREMOLAR · MOLAR^2 · CARNASSIAL · DIASTEMA · DENTICLE · GANOINE ↑ TOOTH^1 → BITE · CHEW

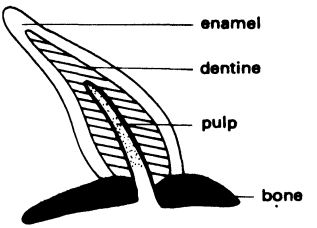
ME079 canine (*n.*) A sharp-pointed conical tooth of a mammal. It is used for grasping prey or tearing flesh, or biting or chewing; it has one root and is located behind the incisors. Also called a **dog-tooth**; the upper canines are also known as **eye-teeth**. They are well developed in carnivores. ↑ INCISOR

ME080 premolar (*n.*) A flat-surfaced tooth with ridges, grooves or cusps on the surface, found in mammals. It is used for crushing, crunching, grinding or munching. It has two roots and is located next to the cheek of the mammal. ↑ INCISOR

ME081 molar^2 (*n.*) A tooth of a mammal similar to a pre-molar in shape and function but located further back in the jaw; it has two or more roots. Molars are present only in permanent teeth. ↑ INCISOR · PREMOLAR

ME082 carnassial (*n.*) The back upper pre-molar and the front lower molar on each side of the jaw of a carnivore. These teeth are particularly large and are modified for shearing flesh from bones; the top and bottom teeth slide past each other with a scissor-like movement. ↑ INCISOR

ME083 diastema (*n.*) A space in the jaw of a mammal in which no teeth erupt; it normally occurs between two different types of teeth, *e.g.* in rabbits, the diastema is the space between incisors and pre-molars. ↑ INCISOR



DENTICLE

ME084 denticle (*n.*) A tooth-like scale consisting of a bony basal plate with a pulp cavity in the centre; the pulp cavity extends in a spine surrounded by dentine; the dentine is covered with enamel. Large denticles function as teeth in cartilaginous fishes, *e.g.* elasmobranchs. Denticles are homologous with the teeth of mammals and teeth are probably modified denticles. Animals with denticles are polyphyodont. —DENTICULATED (*adj.*) ***denticulation*** (*n.*) ↑ TOOTH^1 · INCISOR → PLACOID SCALE · POLYPHYODONT

ME085 ganoine (*n.*) An enamel-like substance composed of modified dentine. ↑ DENTINE · INCISOR

ME086 cusp (*n.*) A sharp-pointed projection on the biting surface of the teeth of mammals. —***cuspidate*** (*adj.*) ***bicuspid*** (*adj.*) ↓ BICUSPID ↑ TOOTH^1

ME087 bicuspid (*adj.*) A tooth possessing two cusps. ↑ CUSP

ME088 dentition (*n.*) **1** The types of teeth and their arrangement in an animal, *e.g.* homodont dentition where all the teeth have the same structure and function. **2** The growth and eruption of teeth. The formation of dentine, enamel and cement constitutes the growth of teeth; the appearance of teeth through the gum is their eruption □ *a rabbit has the dentition of a rodent* ↓ DENTAL FORMULA · DENTISTRY · DENTIST · DENTURE · TARTAR ↑ TOOTH^1

ME089 dental formula (*n.*) Indicates the number of each type of tooth in the upper and lower jaw on one side of a species of mammal, *e.g.* the dental formula of a rabbit is:

$$i\,\frac{2}{1}\ c\,\frac{0}{0}\ p\,\frac{3}{2}\ m\,\frac{3}{3}\ \text{or}\ \frac{2.0.3.3}{1.0.2.3}$$

i = incisor; c = canine; p = pre-molar; m = molar.

The rabbit has 2 incisors in its upper jaw and 1 in its lower jaw; it has 8 teeth on either side of its upper jaw, hence 16 teeth in the upper jaw; it has 6 teeth on either side of its lower jaw, hence 12 teeth in the lower jaw. The full set of permanent teeth is thus 28. ↑ DENTITION

ME090 dentistry The scientific study of teeth, particularly concerning their care. ↑ DENTITION

ME091 dentist A person who practises dentistry. ↑ DENTITION

ME092 denture (*n.*) A set of one or more artificial teeth mounted on a plate which fits onto the gums or palate. ↑ DENTITION

ME093 tartar (*n.*) A hard deposit of calcium phosphate, mixed with other substances, formed at the back of teeth in mammals. ↑ DENTITION

ME094 bite (*v.t.,i.*) **1** (*v.i.*) To cut into a solid substance by bringing the teeth together. **2** (*v.t.*) To seize and grip an object with the teeth □ *the dog bit on the bone; the cat bit into the meat; the crocodile bit off a limb* —BITE (*n.*) ↓ GNAW · NIBBLE ↑ TOOTH[1] → STING[2] · PECK

ME095 gnaw (*v.t.,i.*) To bite a solid continuously, the solid being too hard to be bitten through; to scrape and wear away a solid with the teeth, *e.g.* a dog gnaws a big bone which is too hard for it to crush between its teeth. ↑ BITE

ME096 nibble (*v.t.,i.*) **1** (*v.t.*) To take small quick bites with the front teeth. **2** (*v.i.*) To take small bites, either exploratorily or continuously. —NIBBLE (*n.*) ↑ BITE → EXPLORATORY

ME097 chew (*v.t.,i.*) To reduce solid food to very small pieces by moving it about between the teeth with the tongue, while the different types of teeth grind, crush or bite the food; the action is continuous □ *a man chews a piece of meat* ↓ CRUSH · CRUNCH · GRIND · MUNCH ↑ TOOTH[1]

ME098 crush (*v.t.,i.*) To reduce a solid to small pieces or to a powder, between two surfaces which are pressed together, *e.g.* the molar teeth of carnivores crush small bones. Only an up and down action of the jaw is used. ↑ CHEW

ME099 crunch (*v.t.*) To crush hard foods noisily with the teeth □ *the dog crunched the small bones* ↑ CHEW

ME100 grind (*v.t.,i.*) To reduce a solid to very small pieces or to a powder, between two surfaces which move over each other with a circular movement or which move from side to side, *e.g.* the molar teeth of mammals grind food by moving in a circular manner. ↑ CHEW

ME101 munch (*v.t.*) To chew steadily with visible movements of the jaws, and with some noise, on hard foods, *e.g.* an apple, sugar cane and bamboo can be munched, but bananas, meat and grass are chewed. ↑ CHEW

ME102 dental (*adj.*) Of or to do with the teeth, *e.g.* ***a*** dental caries (caries of the teeth); ***b*** a dental formula is the formula of the teeth; ***c*** a dental nurse. —DENTIST, DENTISTRY, DENTITION, DENTICLE (*n.*) DENTATE (*adj.*) ↓ DENTATE[1] · EDENTATE ↑ TOOTH[1]

ME103 dentate[1] (*adj.*) Having teeth or tooth-like structures; toothed, *e.g.* ***a*** the edge of a leaf may be dentate; ***b*** a cog wheel is dentate. ↑ DENTAL

ME104 edentate (*adj.*) Without teeth or tooth-like projections. ↑ DENTAL

ME105 homodont (*adj.*) Describes teeth which all have the same function and are all similar in form, *e.g.* a frog has homodont teeth. ↓ HETERODONT (I) · THECODONT · MONOPHYDONT · DIPHYODONT · POLYPHYODONT · MONODONT · ZYGODONT ↑ TOOTH[1]

ME106 heterodont (*adj.*) Describes teeth of various kinds each with different functions □ *rabbits have a heterodont dentition* —HETERODONT (*n.*) ↑ HOMODONT (I)

ME107 thecodont (*adj.*) Describes an animal which has teeth set in sockets in the jawbone rather than fused to the jawbone □ *a human being has thecodont teeth* ↑ HOMODONT

ME108 monophyodont (*adj.*) Having only one growth of teeth, *e.g.* as in some whales. ↓ DIPHYODONT (I) · POLYPHYODONT (I) ↑ HOMODONT

ME109 diphyodont (*adj.*) Having two growths of teeth; the first growth is shed before puberty and replaced by the second, permanent growth □ *human beings have a diphyodont dentition* ↓ POLYPHYODONT (I) ↑ HOMODONT · MONOPHYODONT (I) → MILK TEETH

ME110 polyphyodont (*adj.*) Having many growths of teeth, *i.e.* able to form new teeth to replace those worn out or shed by accident, *e.g.* as the denticles in the dogfish. ↑ MONOPHYODONT (I) · DIPHYODONT (I) · HOMODONT

ME111 monodont (*adj.*) Describes an animal with one tooth; the single tooth usually takes the form of a tusk. ↑ HOMODONT

ME112 zygodont (*adj.*) Describes a mammal with molar teeth on which the four cusps are united in two pairs —***zygodontous*** (*adj.*) ↑ HOMODONT

ME113 periodontal (*adj.*) Surrounding a tooth, *e.g.* the periodontal membrane, a layer of tissue surrounding the root of the tooth and connecting it to the socket in the jawbone. ↓ ODONTOID · ODONTOSTOMATOUS ↑ TOOTH[1] → PERIODONTAL MEMBRANE

ME114 odontoid (*adj.*) Tooth-like; describes any structure which is similar to a tooth, *e.g.* the odontoid process, a tooth-like projection formed from part of the first vertebra. ↑ PERIODONTAL → ODONTOID PROCESS

ME115 odontostomatous (*adj.*) Possessing teeth in the buccal cavity or in the jaws. ↑ PERIODONTAL

ME116 mouth parts (*n.*) Structures round the mouth of arthropods which are used for feeding. They are generally paired appendages of the head region; each pair of appendages may be modified to suit the mode of feeding and any pair of appendages may be absent, *e.g.* in the house-fly, the mandible and first maxillae are absent ↓ MANDIBLE · PROBOSCIS · EPIPHARYNGEAL ↑ MOUTH

ME117 mandible (*n.*) **1** (Of arthropods)

one of a pair of mouth parts which usually does most of the work of cutting and crushing solid food. The edge of the mandible is usually toothed. Mandibles work from side to side when cutting solid food. **2** The bone of the lower jaw of vertebrates. —***mandibular*** (*adj.*) ↓ MAXILLA · PREMAXILLA · LABRUM · LABIUM · PALP · GLOSSA · PALPUS · LANCET ↑ MOUTH PARTS

ME118 maxilla (*n.,pl.* **maxillae**) **1** (Of arthropods) one of a pair of mouth parts situated behind the mandibles; each maxilla is a jointed forked structure with a cutting edge on one prong; the maxilla completes the cutting and crushing action of the mandibles and pushes the food into the mouth; the other prong of a maxilla is a palp. Arthropods which suck in liquid food possess grooved maxillae with small teeth along the edge which interlock to form a tube. An arthropod usually possesses two pairs of maxillae, each pair modified for feeding, *e.g.* the house-fly has no mandibles or first maxillae, and the second pair of maxillae are modified to form a tube for conducting liquid food to the mouth; in bees, the labial palps of the second maxillae form a tube for conducting nectar to the mouth. **2** One of the bones of the upper jaw of vertebrates; in mammals it bears all the teeth except incisors. —***maxillary*** (*adj.*) ↑ MANDIBLE

ME119 premaxilla (*n.*) The bone forming the front part of the upper jaw in front of the maxillae of most vertebrates; in mammals, it bears the incisors; in birds, it forms most of the upper beak. ↑ MANDIBLE

ME120 labrum (*n.*) An oblong, plate-like upper lip of an insect which ingests solid food; insects sucking liquid food have a longer, narrower labrum. —***labral*** (*adj.*) ↑ MANDIBLE

ME121 labium (*n.,pl.* **labia**) The lower lip of an insect, usually formed from the second pair of maxillae fused together at the basal parts. ↑ MANDIBLE

ME122 palp (*n.*) **1** (Of insects) a segmented prong of the forked maxilla or the labium; it is a receptor organ for the sense of touch and for some insects an olfactory organ. **2** (Of crustaceans) the distal parts of appendages used for locomotion or for feeding. **3** (Of marine annelid worms) a small tactile appendage on the head. **4** (Of bivalve molluscs) a leaf-like flap of ciliated tissues; there are 4 palps situated around the mouth and they are used to produce currents in the water to send food into the mouth. In some primitive bivalves the pulps are used to transfer food particles to the mouth. —***palpal*** (*adj.*) ↑ MANDIBLE

ME123 glossa (*n.*) A tongue-like mouth part of insects, formed by the fusion of the basal parts of the second pair of maxillae ↑ MANDIBLE

ME124 palpus (*n.pl.* **palpi**) Alternative term for PALP. ↑ MANDIBLE

ME125 proboscis (*n.,pl.* **proboscises, proboscides**) A long, tube-like structure projecting outwards from the mouth or face of an animal, *e.g.* ***a*** the assembled mouth parts, in the form of a tube, of insects which suck liquid food, such as plant juices, blood, etc.; ***b*** the trunk (or nose) of an elephant; ***c*** the tube-like feeler of some marine worms (Nemertinea). —PROBOSCIDEA (*n.pl.*) ↓ EPIPHARYNX · HYPOPHARYNX · LABRUM-EPIPHARYNX · LANCET · STYLET · LABELLUM · PSEUDOTRACHEA · LIGULA ↑ MOUTH PARTS

ME126 epipharynx (*n.*) A projection growing forward from the roof of the mouth of some insects, stretching over the labium; in Diptera, it forms a sharp point. ↑ PROBOSCIS

ME127 hypopharynx (*n.*) A tongue-like structure growing from the floor of the mouth of some insects, particularly Orthoptera. In some Diptera, the hypopharynx is a sharp pointed lancet with a flat blade and a salivary duct running down the middle of the blade. —HYPOPHARYNGEAL (*adj.*) ↑ PROBOSCIS

ME128 labrum-epipharynx (*n.*) A long, sharp-pointed tube formed partly from the labrum and partly from the epipharynx. In some Diptera the labrum-epipharynx is the tube used for sucking liquids; it has a slit along the bottom which is closed by the hypopharynx. ↑ PROBOSCIS

ME129 lancet (*n.*) **1** A small, sharp-pointed, two-edged knife used for making incisions; any object or structure of a similar shape. **2** One of the modified mandibles or first pair of maxillae of insects which possess a proboscis used for piercing skins and sucking blood. Lancets are slender, sharp-pointed modified mouth parts. ↑ MANDIBLE · MAXILLA · PROBOSCIS

ME130 stylet (*n.*) A small, stiff, pointed hair; the term is sometimes used to describe the modified mandibles and first maxillae. Also called ***lancet***. ↑ PROBOSCIS

ME131 labellum (*n.,pl.* **labella**) **1** A long lobe at the end of the labium of some Diptera which use their mouth parts for piercing. **2** One of the flaps at the end of the labium of some Diptera which use their mouth parts for sucking liquid food; the labella have parallel tubes for conducting liquids; these labella are also known as ***oral lobes***. **3** A spoon-shaped part at the front of the glossa of bees. ↑ LABIUM · GLOSSA · PROBOSCIS

ME132 pseudotrachea (*n.pl.*) Very small, parallel tubes in the labella of some Diptera which run from the outside edge of the labellum to a channel leading to the end of the proboscis. The pseudotrachea are strengthened by circular rings of chitin; their function is to conduct liquid food to the tube-like second maxillae. ↑ PROBOSCIS

ME133 ligula (*n.*) (Of insects) a long, tongue-like structure between the labial palps. In bees, the ligula is formed from the inner blades of the second maxillae. ↑ PROBOSCIS · MAXILLA

ME134 epipharyngeal (*adj.*) On or at the back of the pharynx. ↓ HYPOPHARYNGEAL

ME135 hypopharyngeal (*adj.*) Under the pharynx. ↑ EPIPHARYNGEAL

ME136 pharynx (*n.*) (In vertebrates) a thick-walled muscular tube joining the buccal cavity to the oesophagus or gullet. (In lower animals) a muscular tube joining the mouth to the oesophagus. The function of the pharynx is to provide the suction, by contraction and relaxation of its muscular walls, to take food in through the mouth, *i.e.* the process of ingestion. —***pharyngial*** (*adj.*) PHARYNGITIS (*n.*) ***pharyngo-*** (*pref.*) ↓ GLOTTIS · BOLUS · DEGLUTITION · SWALLOW ↑ MOUTH

ME137 glottis (*n.*) The opening of the windpipe (trachea) into the pharynx of vertebrates. In mammals, the vocal cords are stretched across the opening. The glottis can usually be closed by muscles. —***glottal*** (*adj.*) ↓ EPIGLOTTIS · ENDOSTYLE ↑ PHARYNX

ME138 epiglottis (*n.*) A flap of cartilage and mucous membrane above the glottis. When the larynx is raised during swallowing, the glottis is pushed up against the epiglottis and the windpipe (trachea) is closed. ↑ GLOTTIS

ME139 endostyle (*n.*) A ciliated, glandular groove in the wall of the pharynx, found in Urochordata, Cephalochordata and ammocoetes. The glandular epithelium secretes mucus, to which food particles adhere; the beating of the cilia pass the mucus and food down the gullet. The endostyle of the ammocoete develops into the thyroid gland of the adult cyclostome. ↑ GLOTTIS

ME140 bolus (*n.*) **1** A round mass of material. **2** A ball of food formed by the action of the tongue. ↑ PHARYNX → TONGUE

ME141 deglutition (*n.*) (In vertebrates) the action of swallowing. A complicated set of muscular reactions, started by stimulation of the pharynx in which, ***a*** the muscles of the buccal cavity and of the pharynx contract, closing the back of the nose by the soft palate; ***b*** the larynx is raised against the epiglottis and breathing is stopped; ***c*** peristalsis is started in the oesophagus. ↓ GLUTITION · SWALLOW ↑ PHARYNX

ME142 glutition (*n.*) The act by which food gets passed down the pharynx to the oesophagus. ↑ DEGLUTITION

ME143 swallow (*v.t.,i.*) To force a quantity of a solid or liquid from the pharynx into the gullet, *e.g.* to swallow food. —SWALLOW (*n.*) ↓ GULP ↑ PHARYNX → REGURGITATE (Cn)

ME144 gulp (*v.t.*) To swallow without masticating; to swallow by strong muscular effort. ↑ SWALLOW

Gut

MF001 gut (*n.*) An internal structure of all animals except Protozoa and Parazoa concerned with the digestion and absorption of food. In the Coelenterata it is a cavity with one opening to the exterior; in the Platyhelminthes it is a branching tract with one opening; in most animals it is a long tube-like structure, the alimentary canal, with two openings to the exterior. The gut is divisible into a fore-gut, for ingestion and storage, mainly of ectodermal origin; a mid-gut, for digestion and absorption, mainly of endodermal origin; and a hind-gut, for absorption of water and egestion, mainly of ectodermal origin. ↓ ENTERON (Sn) · ALIMENTARY CANAL · ENTERITIS · STOMACH · RUMEN · ENTERIC · GASTRIC · INTESTINE → NUTRITION · LIVER · PANCREAS

MF002 enteron (*n.*) The gut of an animal. An enteron which is a cavity with one opening to the exterior is a coelenteron. An enteron which is a tube with two openings to the exterior is an alimentary canal. —ENTERITIS (*n.*) ENTERIC, ENTERAL (*adj.*) ↓ MESENTERON · PROCTODAEUM ↑ GUT → COELENTERON · COELOM · STOMODAEUM

MF003 mesenteron (*n.*) The mid-gut; the middle part of the alimentary canal lined with endoderm, as opposed to the first and last parts which are lined with ectoderm. In most animals the mesenteron forms the major part of the canal. In arthropods the mesenteron is shorter than the combined length of the stomodaeal and proctodaeal parts. ↑ ENTERON

MF004 proctodaeum (*n.*) **1** An invagination of the ectoderm of a coelomate forming the hind or posterior part of the gut. **2** (In embryos of higher animals) the place where the outer skin is folded in, and where eventually the anus or cloaca develops. —***proctodaeal*** (*adj.*) ↑ ENTERON → STOMODAEUM (Cn)

MF005 alimentary canal (*n.*) A gut which is a tube-like structure with an opening at one end (the mouth) into which food is taken, and an opening at the other end (the anus or cloaca) from which unassimilated food is voided. An alimentary canal is divided into different parts, each with its own structure and function. The parts lying behind the mouth are the buccal cavity, pharynx, and oesophagus. The next parts are concerned with temporary storage of food (the stomach, crop, and gizzard). Then follow the intestines, in which food is finally digested and absorbed, leading to the anus. The structure of the alimentary canal varies considerably from one animal to another, but the parts in turn deal with ingestion, digestion, absorption and egestion. ↓ OESOPHAGUS · GULLET ↑ GUT

MF006 oesophagus (*n.*) The part of the

alimentary canal immediately after the structures used for ingestion. In vertebrates, it follows the pharynx. It is a muscular pipe which, after ingestion, passes food to the digestive parts of the alimentary canal; it has no function other than passing food by peristalsis. —***oesophageal*** (*adj.*) ↑ ALIMENTARY CANAL

MF007 gullet (*n.*) **1** Alternative name for OESOPHAGUS. **2** The pipe leading from cytostome to endoplasm in Protozoa possessing cilia (Ciliophora), such as *Paramecium*). ↑ ALIMENTARY CANAL

MF008 enteritis (*n.*) Inflammation of the intestines. ↓ GASTRITIS ↑ GUT

MF009 gastritis (*n.*) Inflammation of the mucous membrane lining the stomach. ↑ ENTERITIS

MF010 stomach (*n.*) An enlargement of the alimentary canal, forming a sac-like structure, for the temporary storage of food and some processes of digestion. In vertebrates, except birds, it follows the oesophagus. The stomach possesses muscular walls, which churn the food until it is reduced to a mush. Secretory cells line the stomach wall and secrete gastric juices into the stomach. A stomach is either J-shaped or U-shaped. The part of the stomach joined to the gullet is the cardiac side and the part joined to the intestine is the pyloric side. ↓ PYLORUS · CROP[2] · GIZZARD · PROVENTRICULUS · INGLUVIES · PYLORIC SPHINCTER ↑ GUT → GASTRAL

MF011 pylorus (*n.*) A constriction at the end of the stomach leading to the intestine. It is closed by a strong sphincter muscle. The muscle allows partially digested food to leave the stomach when digestion in the stomach has been completed. —***pyloric*** (*adj.*) ↑ STOMACH

MF012 crop[2] (*n.*) **1** (In birds) an enlargement of the alimentary canal to form a pear-shaped sac, for the temporary storage of ingested food. **2** (In invertebrates) a crop having the same structure as in birds, able to store and digest food. ↓ INGLUVIES (Sn) ↑ STOMACH

MF013 gizzard (*n.*) (In birds and most invertebrates) an enlargement of the alimentary canal in the form of a sac, immediately after the crop. The gizzard has strong muscular walls; it may contain small, tooth-like, horny plates on the walls, as in arthropods, or small stones, as in birds, for churning up and grinding food. Some animals, such as earthworms, rely on the muscular walls alone to churn up the food. The churned up food is strained into the intestine. As a general rule, animals without teeth have a crop and gizzard; those with teeth have a stomach. ↑ STOMACH

MF014 proventriculus (*n.*) **1** (In birds) an anterior part of the gizzard where digestive enzymes are secreted. **2** (In decapods and insects) an alternative term for GIZZARD. ↑ STOMACH

MF015 ingluvies (*n.*) Alternative term for CROP (↑). —***ingluvial*** (*adj.*) ↑ STOMACH

MF016 pyloric sphincter (*n.*) A ring of powerful muscles round the pylorus; it closes the pylorus when contracted. ↑ STOMACH

MF017 rumen (*n.*) The first chamber of the complicated stomach of some herbivorous mammals. These animals swallow food whole and store it temporarily in the rumen; it is later passed to the reticulum. Bacterial action in the rumen digests some cellulose and also synthesizes vitamins of the B group, which are absorbed in the gut. Some products of cellulose digestion are absorbed in the rumen. ↓ PAUNCH · RETICULUM · HONEYCOMB BAG · OMASUM · PSALTERIUM · MANYPLIES · ABOMASUM · REED[1] ↑ GUT → RUMINATE · CUD

MF018 paunch (*n.*) An alternative term for RUMEN (↑).

MF019 reticulum (*n.*) The second chamber of the stomach of ruminants. Food is passed from the rumen into the reticulum and is stored there temporarily until the animal's appetite is satisfied. The food (cud) is then regurgitated and chewed in the mouth until it becomes a semi-liquid mush. ↑ RUMEN

MF020 honeycomb bag (*n.*) (Of ruminants) alternative term for RETICULUM; so-called from the pattern of ridges on the mucous membrane which lines the stomach chamber. ↑ RUMEN

MF021 omasum (*n.*) The third chamber of the stomach of a ruminant; it receives the chewed cud and strains it before passing it into the abomasum. ↑ RUMEN → CUD

MF022 psalterium (*n.*) Alternative term for OMASUM. ↑ RUMEN

MF023 manyplies (*n.sing*) Alternative name for OMASUM. ↑ RUMEN

MF024 abomasum (*n.*) The fourth chamber of the stomach of a ruminant. It receives semi-liquid mush from the omasum. The abomasum is the true stomach of the ruminant where gastric juices are secreted for digestion of the food. ↑ RUMEN

MF025 reed[1] (*n.*) Alternative term for ABOMASUM. ↑ RUMEN

MF026 enteric (*adj.*) Of or to do with the gut, *e.g.* enteric fever, a fever caused by bacteria in the gut. —***enteral*** (*adj.*) ↓ ENTERAL ↑ GUT

MF027 enteral (*adj.*) At or near to the gut. ↑ ENTERIC

MF028 gastric (*adj.*) **1** Of or to do with the stomach. **2** (G.S.) Of or to do with digestion. —GASTRITIS (*n.*) ↑ GUT → GASTRAL

MF029 intestine (*n.*) A part of the alimentary canal, in the shape of a long tube which is concerned with the digestion and absorption of nutrients and with the reabsorption of water from faeces. In vertebrates, most of the digestion and almost all the absorption takes place in the intestine. The internal surface area of the intestine is increased by folds in the lining and projections on the lining. The intestine in many animals is coiled in the abdominal cavity; its length is greater than the length of the body. The anterior part of the intestine contains glands for secreting digestive enzymes and receives

ducts from the large digestive glands. —***intestinal*** (*adj.*) ↓ SMALL INTESTINE · VILLUS · LARGE INTESTINE · CAECUM · RECTAL ↑ GUT

MF030 small intestine (*n.*) (In reptiles, birds and mammals) the first or anterior part of the intestine. It is narrower and usually much longer than the second part. Glands in its walls secrete digestive enzymes and ducts from digestive glands deliver enzymes into it. In the small intestine the digestion of food is completed (apart from the digestion of cellulose in herbivores) and the digested food is absorbed. The internal surface area is made larger by ***villi*** projecting from its walls. ↓ DUODENUM (H) · JEJUNUM (H) · ILEUM (H) · SACCULUS ROTUNDUS · ILEO-COLIC VALVE ↑ INTESTINE

MF031 duodenum (*n.*) The first part of the small intestine immediately after the stomach. It is defined as the region into which the bile duct and the pancreatic duct open. It is the widest, shortest part of the small intestine and leads without a defined ending, into the jejunum. It is a region of active digestion. —***duodenal*** (*adj.*) ↑ SMALL INTESTINE

MF032 jejunum (*n.*) The middle part of the small intestine; it is wider than the remaining part and has larger villi. It leads without a defined ending into the ileum. It is the main region of absorption of digested food. —***jejunal*** (*adj.*) ↑ SMALL INTESTINE

MF033 ileum (*n.*) **1** The third and last part of the small intestine, leading into the large intestine. Absorption of digested food is completed in this region. **2** The region of the small intestine, between the duodenum and the large intestine, *i.e.* the term can cover both jejunum and ileum. **3** The first part of the hind gut of an insect, joined to the mesenteron (or midgut) and to the colon. ↑ SMALL INTESTINE

MF034 sacculus rotundus (*n.*) (Of certain herbivores, such as rodents) a small, round swelling at the posterior end of the ileum. Two branches of the gut, the colon and the caecum, lead from it. ↑ SMALL INTESTINE

MF035 ileo-colic valve (*n.*) The valve separating the ileum from the colon, *i.e.* separating the small from the large intestine. ↑ SMALL INTESTINE

MF036 villus (*n.*,*pl.* **villi**) **1** A finger-like projection. **2** One of the finger-like projections on the lining of the small intestine: they are covered with absorptive epithelium. Each villus contains a lacteal, surrounded by capillaries, and smooth muscle which moves the villus continually. Villi increase immensely the area of the small intestine for the absorption of food. All digested food is absorbed through villi. ↓ SPIRAL VALVE · TYPHLOSOLE ↑ INTESTINE

MF037 spiral valve (*n.*) A fold of the mucous membrane of the intestine of some fishes, such as dogfish. The fold projects into the intestine and twists spirally several times round inside the intestine, similar to the twists in a corkscrew. It forces food to travel slowly and to wind round and round, thus increasing the time for absorption and making a large absorptive surface. ↑ VILLUS

MF038 typhlosole (*n.*) A fold of the inner surface of the intestine of some lower animals, such as earthworms. It forms a rounded ridge running the length of the intestine and projecting into the intestine. The typhlosole increases the area of the absorbing surface of the intestine. ↑ VILLUS

MF039 large intestine (*n.*) (In reptiles, birds and mammals) the second, or posterior part of the intestine. It is wider and shorter than the first part, and the two parts are clearly separated by a valve. The large intestine absorbs water from unassimilated food material and forms faeces; in herbivores, cellulose is digested as well. Glands on the wall of the large intestine secrete mucus into it. ↓ COLON (H) · RECTUM (H) · RECTAL GLAND · CLOACA · ANUS · ANAL PORE · CLOACAL APERTURE · CAECUM (H) ↑ INTESTINE

MF040 colon (*n.*) **1** The first or anterior part of the large intestine; it possesses sacculated walls lined with a smooth mucous membrane. In the lining are glands secreting mucus but no digestive enzymes. Water is absorbed from the unassimilated liquid material, leaving faeces. The colon leads directly into the rectum. **2** (In insects) the middle part of the hind gut, between the ileum and the rectum; it is wider than the ileum. —***colic*** (*adj.*) ***colonic*** (*adj.*) ↑ LARGE INTESTINE

MF041 rectum (*n.*) A short tube, the posterior part of the large intestine, which stores faeces and expels them through the anus or cloaca. In most vertebrates other than amphibians it is narrower than the colon. —RECTAL (*adj.*) ↑ LARGE INTESTINE → FAECES

MF042 rectal gland (*n.*) (In some fishes) a small, sac-like branch of the rectum believed to be concerned with osmoregulation of sodium chloride in the animal. ↑ LARGE INTESTINE → OSMOREGULATION

MF043 cloaca (*n.*) A small chamber, at the terminal end of the intestine or gut, with an opening to the exterior (the cloacal aperture). In vertebrates the cloaca has openings from the excretory and genital canals as well as from the intestine. Faeces, urine and gametes are passed to the exterior through the cloaca and cloacal aperture. —CLOACAL (*adj.*) ↓ ANUS (Sn) ↑ LARGE INTESTINE

MF044 anus (*n.*) The terminal opening at the posterior end of the alimentary canal, normally the opening from the rectum. It is kept closed by a sphincter muscle. Through the anus, faeces, bacteria and solid excretions are expelled. Metazoa, other than the Platyhelminthes and Coelenterata, have either an anus or a cloaca □ *faeces are expelled from the anus* ↑ LARGE INTESTINE · CLOACA (Sn)

MF045 anal pore (*n.*) A minute pore in the cuticle of some Protozoa, such as *Paramecium*, through which faeces are egested. Also called ***temporary anus***. ↑ LARGE INTESTINE → EGEST · CUTICLE[2]

MF046 cloacal aperture (*n.*) The opening, closed by muscle, from the cloaca to the exterior. ↑ LARGE INTESTINE

MF047 caecum (*n.,pl.* **caeca**) **1** A caecum is a blind-ending branch of a hollow organ. **2** In some herbivorous mammals, such as rodents and sheep, the caecum is a wide, long, thin-walled branch of the large intestine; it has a blind ending into which the vermiform appendix opens. In such animals, bacteria in the caecum digest cellulose, forming sugars which are absorbed in the caecum and colon. **3** In carnivores and man the caecum is rudimentary; it is a sac-like blind ending of the large intestine, anterior to the ileo-colic valve; it has no function. **4** In amniotes and small fishes there may be two small caeca at the junction of the small and large intestines. —***caecal*** (*adj.*) ↓ HEPATIC CAECUM · VERMIFORM APPENDIX · APPENDIX · HEPATOPANCREAS ↑ INTESTINE

MF048 hepatic caecum (*n.*) (In insects) a narrow tube with a blind ending, leading from the anterior of the midgut near its junction with the gizzard. The digestive juices of insects are chiefly secreted by glands in the walls of hepatic caeca. There are several hepatic caeca, (eight in the cockroach) leading from the mid-gut; they increase the area of absorption. ↑ CAECUM

MF049 vermiform appendix (*n.*) A small, worm-like tube with a blind ending; it has an opening leading from the blind end of the caecum and contains lymphoid tissue. ↑ CAECUM

MF050 appendix (*n.*) (G.S.) Alternative term for VERMIFORM APPENDIX. ↑ CAECUM

MF051 hepatopancreas (*n.*) (In crustaceans) a mass of glandular tissue communicating with the midgut by means of a duct; it secretes digestive enzymes. ↑ CAECUM

MF052 rectal (*adj.*) Of, near to, or to do with the rectum. ↓ CLOACAL · ANAL ↑ INTESTINE

MF053 cloacal (*adj.*) Of, near to, or to do with the cloaca. ↑ RECTAL

MF054 anal (*adj.*) Of or near the anus, *e.g.* the anal fin of a fish is on the ventral side of a fish, sometimes united with the tail fin, and near the anus. ↑ RECTAL

Digestion

MG001 digestion (*n.*) The breakdown of complex organic substances, used as foodstuffs, to simpler compounds which can be absorbed by an organism for metabolism. Digestion takes place in all animals and in those plants which are not entirely autotrophic. The process involves a sequence of chemical reactions catalysed by enzymes. The process can be intracellular or extracellular and is either internal or external. —DIGESTIVE, DIGESTIBLE (*adj.*) ***digest*** (*v.*) ↓ INTRACELLULAR DIGESTION · INTERNAL DIGESTION · CHYLE · FAECES · JUICE · REGURGITATE · EGEST · DIGESTIVE · GASTRAL · PEPTIDE → NUTRITION

MG002 intracellular digestion (*n.*) **1** Amoeboid unicellular organisms engulf food particles and form a food vacuole around the particle. Digestive enzymes enter the vacuole and the food particle is digested. This is intracellular digestion. **2** In coelenterates and lamellibranchs, food is partially digested in the enteron or gut by secreted enzymes; food particles are then engulfed by amoeboid cells and digestion is completed intracellularly. ↓ EXTRACELLULAR DIGESTION ↑ DIGESTION

MG003 extracellular digestion (*n.*) Certain cells in an organism develop secretory functions and secrete enzymes (exoenzymes) for digestion. In most cases the enzymes are mixed with foodstuffs in an enteron or gut and the enzymes digest the foodstuffs extracellularly. Other cells absorb the product. ↑ INTRACELLULAR DIGESTION

MG004 internal digestion (*n.*) In coelomate animals foodstuffs are passed into the gut where secretory cells pour digestive enzymes on the foodstuffs. Internal digestion takes place within an organism; it is an extracellular process. ↓ EXTERNAL DIGESTION · ABSORPTION[2] · ASSIMILATION · PERISTALSIS ↑ DIGESTION

MG005 external digestion (*n.*) Fungi secrete extracellular enzymes which partially digest the substrate on which the fungus is feeding; digestion is completed intracellularly. External digestion takes place outside an organism; it is an extracellular process. ↑ INTERNAL DIGESTION

MG006 absorption[2] (*n.*) The process in which soluble substances in solution pass through a membrane into an organism. The membrane can be the plasma membrane of a cell or of a vacuole, or it can be an epithelium. The membrane in most cases will exhibit differential permeability, *i.e.* the permeability will vary with each dissolved substance; the permeability for any particular substance may also vary with the physiological state of a cell. In some cases, absorption may take place by pinocytosis. The passage of the solute through a membrane can be effected by passive or active transport. —ABSORB (*v.*) ↑ INTERNAL DIGESTION → PINOCYTOSIS · ACTIVE TRANSPORT

MG007 assimilation (*n.*) The process of taking the absorbed end-products of digestion and synthesizing from them protoplasm and intercellular material; it is mainly an anabolic process, part of metabolism.

—***assimilate*** (*v.*) ↑ INTERNAL DIGESTION

MG008 peristalsis (*n.*) An action of smooth muscle in which waves of contraction pass along the muscles enclosing tubular organs, especially the intestines. Peristalsis mixes the contents of the tubular organs and passes them along the organ from one end to the other. —***peristaltic*** (*adj.*) ↑ INTERNAL DIGESTION

MG009 chyle (*n.*) A liquid formed in the lacteals of villi; it consists of globules of emulsified fat in lymph. ↓ CHYME · MUSH · CUD · PANCREATIN · VOMIT[1] ↑ DIGESTION

MG010 chyme (*n.*) Partially digested food passed on from the stomach, through the pylorus to the intestine; it is a soft, almost liquid mass (a **mush**) —***chymification*** (*n.*) ***chymiferous*** (*adj.*) ↑ CHYLE → STOMACH

MG011 mush (*n.*) A mixture of solid particles and liquid, capable of flowing slowly and intermittently along a pipe. A mush has the appearance of a thick, viscous liquid. —***mushy*** (*adj.*) ↑ CHYLE

MG012 cud (*n.*) (In ruminants) partly digested food from the rumen and reticulum, regurgitated for further mastication □ *a cow chews the cud* ↑ CHYLE → RUMEN

MG013 pancreatin (*n.*) Extract of pancreas containing digestive enzymes, used medically to assist digestion. ↑ CHYLE

MG014 vomit[1] (*n.*) Stomach contents which have been vomited. ↓ VOMIT[2] ↑ CHYLE

MG015 faeces (*n.pl.*) The undigested remains of food, together with bacteria and the residue of digestive secretions, which are expelled from an animal, *e.g.* ***a*** an amoeba flows along leaving faeces behind; the faeces are egested; ***b*** faeces are egested through the mouth of a hydra, ***c*** faeces are egested through the cloaca of a vertebrate; ***d*** faeces are expelled through the anus of a mammal. Note: faeces and excreta are entirely different. Faeces are those substances or materials which cannot be used by an animal and are *egested.* Excreta are the waste products of metabolism, particularly respiration; the original substances have been used by the organism and the metabolic products are of no further use so they are *excreted.* Both plants and animals excrete excreta □ *faeces are egested from an animal; faeces are voided from an organism; faeces are expelled from an animal* —***faecal*** (*adj.*) DEFAECATION (*n.*) DEFAECATE (*v.*) ↓ DEFAECATION · EGESTION · VOMITING ↑ DIGESTION → EXCRETA · RECTUM

MG016 defaecation (*n.*) The passing out of faeces from the body of an animal; in coelenterates and flatworms, faeces leave through the mouth or pharynx, as the enteron or gut has only one opening. In other animals, the faeces are passed through an anus, a cloaca, or an anal pore. ↑ FAECES

MG017 egestion (*n.*) The process of egesting. It can differ from defaecation in some animals, *e.g.* the musculo-epithelial cells of coelenterates egest indigestible material (egestion). The egested material collects in the enteron and is passed out periodically as a whole mass of faeces; this is defaecation. Egestion is the general term for the elimination of indigestible material, and defaecation is limited to the passage of faeces through an opening from a gut. ↑ FAECES

MG018 vomiting (*n.*) The action of discharging vomit. ↓ VOMIT[2] ↑ FAECES

MG019 juice (*n.*) **1** The liquid part of plant cells, particularly in fruits. Fruit juice is obtained by squeezing the fruit. **2** A liquid secretion from a digestive gland; it contains digestive enzymes in water, *e.g.* gastric juice, pancreatic juice. —***juicy*** (*adj.*) ↓ GASTRIC JUICE · PANCREATIC JUICE · INTESTINAL JUICE · SUCCUS ENTERICUS ↑ DIGESTION

MG020 gastric juice (*n.*) A secretion, from glands in the stomach wall, containing hydrochloric acid (0·2%–0·5%) and digestive enzymes, *e.g.* pepsin, and, in young mammals only, rennin. ↑ JUICE → STOMACH

MG021 pancreatic juice (*n.*) A digestive juice containing a mixture of the enzymes amylase, trypsinogen and lipase; it is made alkaline by bile. ↑ JUICE

MG022 intestinal juice (*n.*) (In vertebrates) the digestive juice secreted by intestinal glands in the small intestine. The juice contains numerous enzymes, ***a*** enterokinase, which activates trypsinogen, and erepsin, a mixture of enzymes; these enzymes complete the digestion of proteins to amino acids; ***b*** sucrase, lactase, maltase and amylopsin (amylase); these enzymes complete the digestion of carbohydrates to glucose (or a monosaccharide); ***c*** steapsin (a lipase) which completes the hydrolysis of fat. The juice is alkaline. ↑ JUICE

MG023 succus entericus (*n.*) Alternative term for INTESTINAL JUICE. ↑ JUICE

MG024 regurgitate (*v.t.*) To bring back into the mouth food which has passed down the oesophagus, or into the stomach, *e.g.* ***a*** to regurgitate food due to illness; ***b*** (of birds) to regurgitate food to feed young; ***c*** (of ruminants) to regurgitate food to masticate it. **Regurgitation** usually implies control over the action, as opposed to **vomiting**, which is an uncontrolled action. —***regurgitation*** (*n.*) ***regurgitated*** (*adj.*) ↓ RETCH · VOMIT[2] (Sn) ↑ DIGESTION

MG025 retch (*v.i.*) To make the muscular movement of vomiting, especially without discharging vomit. ↑ REGURGITATE

MG026 vomit[2] (*v.i.*) To discharge the contents of the stomach, with violent muscular effort, through the mouth. —VOMIT (*n.*) VOMITING (*n.*) ↑ REGURGITATE

MG027 egest (*v.i.*) To get rid of food materials which cannot be digested or assimilated by an animal, *e.g.* faeces are egested. —EGESTION (*n.*) ↓ VOID · DEFAECATE ↑ DIGESTION → EVISCERATE · INGEST (Cn)

MG028 void (*v.t.*) To empty the contents of a vessel or receptacle, especially the contents of the rectum through the anus when accompanied by muscular contractions to

assist the passage of faeces. —***void*** (*n.*) ***void*** (*adj.*) ↑ EGEST

MG029 defaecate *or* **defecate** (*v.i.*) To expel faeces from the anus or cloaca. The emphasis of defaecating (*v.i.*) is on the expulsion of faeces, as opposed to **voiding** (*v.t.*), where the emphasis is on emptying the rectum. —***defaecation*** (*n.*) ↑ EGEST

MG030 digestive (*adj.*) Describes an agent of digestion, *e.g.* ***a*** an enzyme taking part in digestion is a digestive enzyme; ***b*** a process which changes maltose to glucose, *i.e.* digestion is a digestive process; ***c*** the liver of a vertebrate is a digestive organ. ↓ DIGESTIBLE · INDIGESTIBLE ↑ DIGESTION

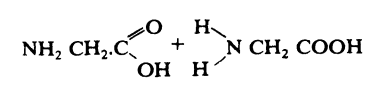
MG031 digestible (*adj.*) Describes a substance, foodstuff or substrate, which has the disposition to be digested by a named organism; if the organism is unnamed it is usually assumed to be man, *e.g.* ***a*** cellulose is digestible by earthworms; ***b*** all sugars are digestible, *i.e.* digestible by man □ *sucrose is readily digestible by vertebrates; excess fat in a diet is only digestible with difficulty* ↓ INDIGESTIBLE (I) ↑ DIGESTIVE

MG032 indigestible (*adj.*) Describes a substance which cannot be digested by a named organism or by man, *e.g.* cellulose is an indigestible substance for carnivores. ↑ DIGESTIVE · DIGESTIBLE (I)

MG033 gastral (*adj.*) Of or to do with the stomach in its process of digestion; the focus is on the function of the stomach, or any other structure considered to replace the stomach in its function, *e.g.* the gastral epithelium of a sponge is composed of cells (choanocytes) which ingest and partially digest food particles. To contrast **gastric, enteric** and **gastral,** ***a gastric*** is applied to the stomach or a region of the stomach, *e.g.* the gastric artery leads to the stomach; gastric glands are in the walls of the stomach; ***b enteric*** is applied to the whole gut or to the alimentary canal as opposed to the stomach alone; the focus is on the region and not on the function; ***c gastral*** indicates digestive properties resembling those of the stomach or gut, *e.g.* a gastral cavity in sponges; the gastral epithelium of the enteron of coelenterates. ↑ DIGESTION

MG034 peptide (*n.*) A compound formed from two or more amino acids joined by a peptide bond. The term is general and can include polypeptides, peptones, and proteoses; a protein is virtually a peptide but has additional characteristics. ↓ PEPTIDE BOND · PROTEOSE ↑ DIGESTION

MG035 peptide bond (*n.*) The amino group ($—NH_2$) of one amino acid joins with the carboxyl group (—COOH) of another amino acid and water is eliminated to form the bond. Chemically this is a condensation reaction. The simplest reaction is between two molecules of glycine:



$$NH_2\,CH_2.C(=O)OH + H\,N\,CH_2\,COOH \rightarrow NH_2\,CH_2\,C(=O)—NH\,CH_2\,COOH$$

peptide bond

The peptide bond is hydrolysed by proteolytic enzymes to split the compound into its two original molecules. ↑ PEPTIDE

MG036 proteose (*n.*) The first products of the breakdown of proteins by enzymatic action; a more complex compound than a peptone. ↓ PEPTONE · POLYPEPTIDE ↑ PEPTIDE

MG037 peptone (*n.*) A product formed when proteins are broken down by enzymatic action, *e.g.* as by pepsin; it is more complex than a polypeptide, but there is no clear distinction between the two. ↑ PROTEOSE

MG038 polypeptide (*n.*) **1** A peptide composed of more than two amino acids, but less complex than a peptone. **2** (In biochemistry) any peptide with a molecular weight of under 6000 or consisting of about 50 or less amino acids. Above these limits the compound starts to have the properties of a protein. ↑ PROTEOSE

Diet

MH001 diet (*n.*) The type, quality and quantity of the different foods eaten by an animal. For man, it is sometimes described in terms of the staple form of carbohydrate, *e.g.* a rice diet, a maize diet. Other foods are eaten to give variety and balance in the diet. The chief and sometimes only food of animals is also used to categorize feeding habits, *e.g.* fruit-eating animals, insectivorous animals. —***dietary*** (*adj.*) ↓ CARBOHYDRATE[2] · PULSES · APPETITE · DIETETICS · PROCESSED FOOD · CONSUME[2] · PRESERVE · EDIBLE · RAVENOUS · SARCOPHAGOUS · VITAMIN · VITAMIN B-COMPLEX → NUTRITION

MH002 carbohydrate[2] (*n.*) Dietary carbohydrates include starches, disaccharides and monosaccharides, *i.e.* the edible carbohydrates. They play an essential part in the metabolism of all organisms, whether plant or animal, being the chief source of energy for all biological functions. ↓ ESSENTIAL AMINO ACIDS · MINERAL SALTS · PROTEIN QUALITY · PROTEIN SCORE ↑ DIET → MONOSACCHARIDE[2]

MH003 essential amino acids (*n.pl.*) Animals can synthesize some amino acids by transamination, but there are eight (for human beings) that cannot be synthesized. These amino acids are called essential

amino acids; they are leucine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Infants require a further two, histidine and arginine. With these eight amino acids, the human body can synthesize all the remaining amino acids in the correct proportion required by its metabolic system; infants require the further two, histidine and arginine, to maintain growth. The list of essential amino acids has been found to be almost the same for other animal organisms, *e.g.* some vertebrates, insects, and even a ciliophoran. ↑ CARBOHYDRATE[2] → PROTEIN

MH004 mineral salts (*n.pl.*) The mineral ions considered essential for a normal diet; the term includes the ions of calcium, iron, sodium, phosphorus, chlorine, and iodine. Lack of calcium and phosphate ions causes rickets and osteomalacia; lack of calcium ions prevents blood clotting. Lack of iron causes anaemia; lack of iodine causes goitre. Lack of sodium and chlorine ions causes heat exhaustion. ↑ CARBOHYDRATE[2]

MH005 protein quality (*n.*) The nutritive value of a protein in food depends upon the balance of essential amino acids it contains in relation to the balance of essential amino acids required by an animal eating the protein. For human beings, high quality dietary protein contains essential amino acids in nearly the same proportions as in the body. Protein from animal sources is generally of high quality; protein from vegetable sources is of average to low quality; protein from two or more vegetable sources may provide high quality protein from the mixture of essential amino acids. ↑ CARBOHYDRATE[2]

MH006 protein score (*n.*) A form of assessment of protein quality; egg protein is taken as a standard. All other proteins are assessed by taking the content of the amino acid which is least adequate in a protein, and comparing it with the content of that amino acid in egg protein. This gives a percentage factor which becomes the protein score, *e.g.* in maize, the amino acid tryptophan is deficient; the tryptophan content of maize is 45% of the tryptophan content of egg protein; the protein score of maize is 45%. ↑ CARBOHYDRATE[2]

MH007 pulses (*n.pl.*) Seeds of the family Leguminosae, *e.g.* peas, and all types of beans, fresh or dried. ↓ CEREAL · MILK PRODUCTS · BEVERAGE · BROTH · DAIRY PRODUCTS ↑ DIET

MH008 cereal (*n.*) 1 A plant of the family Gramineae, whose seeds are used for food, *e.g.* wheat, rice, maize, sorghum, barley, oats. 2 The processed food from a cereal plant, *e.g.* flour, bread, etc. ↑ PULSES

MH009 milk products (*n.pl.*) Processed foods obtained from milk; they include sour milk (yoghurt), butter, cream, and all varieties of cheese. ↑ PULSES

MH010 beverage (*n.*) Any flavoured liquid such as tea, coffee, cocoa, wine, beer, fruit juices, etc. ↑ PULSES

MH011 broth (*n.*) Water in which meat is boiled, then strained to remove all solids, forms broth; used in the culture of bacteria. ↑ PULSES

MH012 dairy products (*n.pl.*) Alternative term for MILK PRODUCTS. ↑ PULSES

MH013 appetite (*n.*) (In man) a desire for a particular food, based on its quality and nature, depending on the person's immediate physical environment and his eating habits and customs. Contrast **hunger,** which is a sensation arising from physiological changes in the body. Hunger is inhibited by fullness, a sensation arising in the alimentary canal. Appetite is inhibited by satiety. ↓ SATIETY (Cn) · FULLNESS ↑ DIET

MH014 satiety (*n.*) (In man) a lack of desire for food which can be the result of having eaten enough to satisfy the appetite or it may be that the quality and nature of the food is unacceptable, or that the physical environment, eating habits and customs may be inhibiting. —***satiated*** (*adj.*) ↑ APPETITE

MH015 fullness (*n.*) A sensation arising in the alimentary canal from the presence of an adequate quantity of food. ↑ APPETITE

MH016 dietetics (*n.sing.*) The study of diets and their effects; usually restricted to diets of human beings and higher vertebrates. ↓ BALANCED DIET · MALNUTRITION · AVITAMINOSIS ↑ DIET

MH017 balanced diet (*n.*) Describes the optimum intake of food for human beings; it varies with age, sex, and other conditions. A balanced diet must supply sufficient carbohydrate and fat to provide energy for work, sufficient protein to replace loss of amino acids, and a variety of foods to supply sufficient vitamins and mineral salts. Protein in a diet supplies energy as well as amino acids and in a balanced diet the proportion of energy supplied from each type of food should be: 20%–30% from fat, 10%–12% from protein, and the balance from carbohydrate. Protein should be of mixed animal and plant origin. ↑ DIETETICS

MH018 malnutrition (*n.*) A condition in which an unbalanced diet provides the body with too little or too much nutriment, or in which the body does not assimilate sufficient of the digested food products. The diet can be unbalanced because the quantities or the quality of the foods is unsuitable, *e.g.* ***a*** intestinal infections and worm infestations can cause malnutrition because only part of the food is assimilated; ***b*** protein in the diet may be of poor quality (low protein score); ***c*** the diet may not provide sufficient vitamins or mineral salts. ↑ DIETETICS

MH019 avitaminosis (*n.*) A condition caused by deficiency of vitamins in the diet; a form of malnutrition gives rise to the condition. The condition may be subclinical, or if severe, may give rise to deficiency diseases. ↑ DIETETICS → VITAMIN DEFICIENCY

MH020 processed food (*n.*) The addition of chemicals to raw food to allow the food to

be preserved for distribution to populations in towns and other countries. The substances added include preserving agents, colouring agents, sweetening agents, flavouring agents, and antoxidants. ↑ DIET

MH021 consume[2] (*v.t.*) Food and liquids are consumed when taken in by an animal during eating and drinking; the focus is on the steady disappearance of the food or drink, *e.g.* a caterpillar consumes a leaf in a few hours. Contrast **eats**: a caterpillar eats leaves (leaves are its staple food, or leaves form its food); a caterpillar consumes a leaf (the leaf is gradually eaten). —***consumption*** (*n.*) ↓ STARVE ↑ DIET

MH022 starve (*v.t.,i.*) **1** (*v.i.*) To go without food or to be deprived of food. **2** (*v.t.*) To deprive of food or of sufficient food, *e.g.* a patient is starved for a day before a surgical operation on his abdomen (the patient is not given any food). A person who is starved, or who is starving, lacks solid food, but does not necessarily lack liquids to drink. —***starvation*** (*n.*) ***starved, starving*** (*adj.*) ↑ CONSUME[2]

MH023 preserve (*v.t.*) To add such substances to food as will prevent bacterial and fungal attack during storage, *e.g.* salt, sugar, and vinegar, are the preserving agents in longest use; they have been replaced by chemicals such as sulphur dioxide and benzoic acid. Food can also be preserved by dehydration. —***preservative*** (*adj.*) ***preservation*** (*n.*) ↑ DIET

MH024 edible (*adj.*) A substance, animal, or plant product, that can be digested and assimilated by an animal and is not poisonous. ↓ EATABLE · STAPLE · MACROPHAGOUS · MICROPHAGOUS ↑ DIET

MH025 eatable (*adj.*) An edible substance for which a person can have an appetite, *i.e.* it is fit or suitable, to be eaten. To contrast **edible** and **eatable**: the maggots of houseflies are edible, but not eatable. ↑ EDIBLE

MH026 staple (*adj.*) Describes the chief kind of cereal in a diet, *e.g.* wheat is the staple cereal in most European countries, *i.e.* wheat is the most important cereal eaten to provide energy. ↑ EDIBLE

MH027 macrophagous (*adj.*) (Of animals) feeding at intervals on pieces of food which are large compared with the size of the animal. ↓ MICROPHAGOUS (Cn) ↑ EDIBLE

MH028 microphagous (*adj.*) (Of animals) feeding almost continuously on pieces of food which are microscopic. Aquatic forms, *e.g.* barnacles, tend to feed by sieving food particles, such as plankton, from water; the water flows in a current generated by ciliary action or the movement of appendages. ↑ EDIBLE · MACROPHAGOUS (Cn)

MH029 ravenous (*adj.*) **1** Describes a person who is extremely hungry and has an appetite for a wider range of foods than is his usual habit. **2** Describes the appetite of a ravenous person □ *a starving person has a ravenous appetite* ↑ DIET

MH030 sarcophagous (*adj.*) (Of animals) flesh-eating, carnivorous. ↓ FRUGIVOROUS · FOLICOLOUS · PISCIVOROUS · COPROPHAGOUS · MYCETOPHAGOUS · FUNGIVOROUS · FUCIVOROUS ↑ DIET

MH031 frugivorous (*adj.*) (Of animals) feeding on fruit. ↑ SARCOPHAGOUS

MH032 folicolous (*adj.*) (Of animals) feeding on leaves. ↑ SARCOPHAGOUS

MH033 piscivorous (*adj.*) Fish-eating. ↑ SARCOPHAGOUS

MH034 coprophagous (*adj.*) Feeding on dung. ↑ SARCOPHAGOUS

MH035 mycetophagous (*adj.*) Feeding on fungi; fungivorous. ↑ SARCOPHAGOUS

MH036 fungivorous (*adj.*) Describes animals which eat fungi. ↑ SARCOPHAGOUS

MH037 fucivorous (*adj.*) (Of animals) having seaweed as a staple diet. ↑ SARCOPHAGOUS

MH038 vitamin (*n.*) One of a number of complex organic substances which an animal or a heterotrophic plant must obtain from its environment, although the amount required daily is very small. Each vitamin plays an essential part in the metabolism of an organism, almost always as an enzyme in a system of enzymes. In acting as an enzyme, the vitamin is broken down, *i.e.* it is decomposed, like many other enzymes, but only small amounts are required for replacement to catalyse metabolic reactions. In some cases, an animal can synthesize part of its requirement of a particular vitamin, especially if provided with particular substances for use in this synthesis. In other cases, symbiotic organisms supply part of the requirement of a particular vitamin. A vitamin required by one kind of organism may not be needed by other kinds, firstly because the other organisms may synthesize it, so it is not a vitamin by definition, or secondly the other organisms may not use it in their metabolism. There are no universal vitamins required by all organisms; each specific organism has its own requirements for vitamins. Besides man, few other organisms have been studied in detail; the vitamins required by man are those usually discussed, and reference may be made to their utilization in other animals. Every vitamin required by a particular organism must be synthesized by some other organism, otherwise it would not be available in a diet. Other compounds are known which can be substituted for vitamins; they are called vitamers. —VITAMINIZE (*v.*) ↓ VITAMER · RETINOL · CALCIFEROL · VITAMIN C · VITAMINOLOGY · VITAMINIZE ↑ DIET → ENZYME

MH039 vitamer (*n.*) A substance which substitutes for a vitamin in the requirements of an organism. The vitamer may have a specific chemical grouping which is the same as the chemical grouping in part of the vitamin molecule which catalyzes the metabolic reaction, or it may have a closely related chemical grouping which the organism can convert into the required chemical grouping of a vitamin. ↓ PROVITAMIN · VITAZYME ↑ VITAMIN

MH040 provitamin (*n.*) A substance (a vitamer) which can be converted by metabolic action into a vitamin. ↑ VITAMER

MH041 vitazyme (*n.*) An enzyme which incorporates a vitamin in its molecule. ↑ VITAMER

MH042 retinol (*n.*) A fat-soluble, yellow oil stored in the liver; it is not excreted and can accumulate in the body to produce toxic effects. Retinol is used in the body to produce visual purple, the pigment in rods of the retina; a deficiency impairs vision. A deficiency also causes epithelial cells to become flattened and heaped up on one another; this leads to xerophthalmia, and also to the formation of hard, rough skin. Retinol is required by man and other vertebrates but not by other animals. It is found only in foods of animal origin. The carotenes are provitamins for retinol; they are converted to retinol in the liver. ↓ VITAMIN E · VITAMIN K · VITAMIN A · TOCOPHERALS ↑ VITAMIN

MH043 vitamin E (*n.*) A fat-soluble, yellow oil required by man and all other vertebrates; it is found in almost all foods and deficiency in man has not been recorded. It acts as an antoxidant in metabolism, and slows down the rate of metabolism, as required. Artificially induced deficiency in rats causes abortion in females and sterility in males. There is no evidence that excess of the vitamin is toxic, even though it is fat-soluble. ↑ RETINOL.

MH044 vitamin K (*n.*) A fat-soluble, yellow oil required by man and other mammals and birds. There are various compounds all with the same action. The vitamin is necessary for the formation of prothrombin in the liver and hence necessary for the clotting of blood. Man appears to be independent of a source of the vitamin in his diet owing to synthesis of the vitamin by bacteria in the gut (symbiotic supply). A deficiency causes proneness to haemorrhage. A water-soluble form has been synthesized. ↑ RETINOL

MH045 vitamin A (*n.*) Alternative term for RETINOL (↑).

MH046 tocopherols (*n.pl.*) Different forms of vitamin E are called tocopherols; the mixture of the compounds is known as vitamin E. ↑ RETINOL

MH047 calciferol (*n.*) A term used to describe various forms of vitamin D, *i.e.* D_1, D_2, D_3. Vitamin D_1 was the first to be discovered and was subsequently found to be impure. The two important forms of the vitamin are D_2 and D_3. The vitamin is fat-soluble and is needed for the absorption and assimilation of calcium and phosphate ions from food. The vitamin aids the deposition of these ions in bones and their use in other tissues. Lack of the vitamins may cause rickets or osteomalacia. The vitamin is needed by man and all other vertebrates. ↓ CHOLECALCIFEROL · ERGOLALCIFEROL · VITAMIN D · VITAMIN D_2 · VITAMIN D_3 ↑ VITAMIN

MH048 cholecalciferol (*n.*) This is the naturally occurring form of the vitamin D. It is produced by the action of ultra-violet light on a derivative of cholesterol and is formed in the skin. Many people get little or no vitamin D from their diet; both human and cow's milk contain negligible amounts of the vitamin. It has been suggested that requirements of the vitamin should be obtained naturally from exposure of the skin to sunlight. The vitamin is not excreted, it is stored in the liver, and an excess is toxic. The rate of synthesis depends on the extent of exposure to sunlight and on the pigmentation of the skin. The deeper the pigmentation, the slower the rate of synthesis, hence skin pigmentation on exposure to sunlight is a defence mechanism against the toxic effects of excess vitamin. ↑ CALCIFEROL

MH049 ergocalciferol (*n.*) A substance formed by exposing ergosterol to the action of ultra-violet light; ergosterol occurs only in plants. Ergocalciferol is available in small quantities in fish-liver oils. It is used in the therapeutic treatment of deficiency disease of vitamin D. ↑ CALCIFEROL

MH050 vitamin D (*n.*) See CALCIFEROL. ↑ CALCIFEROL

MH051 vitamin D_2 (*n.*) Alternative name for ERGOCALCIFEROL. ↑ CALCIFEROL

MH052 vitamin D_3 (*n.*) Alternative term for CHOLECALCIFEROL. ↑ CALCIFEROL

MH053 vitamin C (*n.*) A water-soluble vitamin required by primates and a few other species of mammals and birds; other animals can synthesize it. It is widely distributed in fresh green vegetables and in fruit. Vitamin C is necessary for the proper formation of matrixes in tissues, *e.g.* the formation of collagen and of the cement binding teeth to gums. Deficiency of the vitamin causes scurvy, weakness of capillary walls leading to haemorrhage in bruising, a lowering of resistance to disease, and poor healing of wounds. Excess vitamin is not stored but lost in excretion. ↓ LINOLEIC ACID · VITAMIN F · ASCORBIC ACID ↑ VITAMIN

MH054 linoleic acid (*n.*) An unsaturated fatty acid, called an **essential fatty acid**, required in small amounts, probably by all animals; it occurs extensively in many vegetable oils. ↑ VITAMIN C

MH055 vitamin F (*n.*) Alternative term for LINOLEIC ACID. ↑ VITAMIN C

MH056 ascorbic acid (*n.*) Chemical name for vitamin C. ↑ VITAMIN C

MH057 vitaminology (*n.*) The study of vitamins and their physiological effect. ↓ VITAMIN DEFICIENCY ↑ VITAMIN

MH058 vitamin deficiency (*n*) A severe deficiency causes clinical signs and symptoms of disease. A mild deficiency, called a sub-clinical deficiency, may cause general ill-health, or may make a person more liable to disease. A deficiency reduces the rate of metabolism for the specific reaction associated with the vitamin; this may affect the whole metabolic rate or specific sections

of metabolism. The general effect of deficiency is to stunt the growth of young animals. ↑ VITAMINOLOGY

MH059 vitaminize (*v.t.*) To add vitamins to food. Modern processing of food often destroys the natural vitamins; synthesized vitamins are added to restore the vitamin content or to enrich the food with other vitamins. Either process vitaminizes the food. ↑ VITAMIN

MH060 vitamin B-complex (*n.*) A mixture of several water-soluble vitamins, originally thought to be a single vitamin. It includes vitamins B_1, B_2, B_6, B_7, B_{12} and pantothenic acid. ↓ THIAMIN · VITAMIN B_1 · LACTOFLAVIN ↑ DIET

MH061 thiamin *or* **thiamine** (*n.*) A vitamin of the B-complex, required by man, all other vertebrates, and by insects; all plant and animal tissues contain it, but the most important source is in the seeds of plants. It functions as part of the enzyme system in the breakdown of carbohydrates, being the coenzyme of carboxylase. A severe deficiency causes beri-beri in man and similar signs in other animals. It is not stored in any organ, excess being excreted; excess vitamin is not toxic. ↓ RIBOFLAVIN · PYRIDOXINE · NICOTINIC ACID · COBALAMIN · FOLIC ACID · PANTOTHENIC ACID · BIOTIN ↑ VITAMIN B-COMPLEX

MH062 riboflavin (*n.*) A vitamin of the B-complex; required by man and other vertebrates, by insects and by some bacteria. It is widely distributed, occurring in most plants and animals, but a deficiency can arise from some diets. Liver, lean meat, and yeast, are good sources. It functions as part of the enzyme system in cell respiration. A severe deficiency causes conjunctivitis, and lesions on skin and mucous membranes; a deficiency can also retard growth in children. ↑ THIAMIN

MH063 pyridoxine (*n.*) A vitamin of the B-complex, comprised of several compounds; required by mammals, birds, insects, bacteria, and by some of the yeasts. It is widely distributed in most organisms and dietary deficiencies in man are rare. It functions as a coenzyme in many aminotranferases. A deficiency produces no clinical features. ↑ THIAMIN

MH064 nicotinic acid (*n.*) A vitamin of the B-complex; required by vertebrates and by insects. It is widely distributed in plant and animal tissues; good sources include yeast, liver, lean meat, and whole cereals. A diet with maize as the staple cereal gives rise to a deficiency of nicotinic acid. The vitamin functions in the system of respiratory enzymes and is used in the synthesis of NAD by the body. The vitamin can be synthesized from the amino acid tryptophan. Severe deficiency causes pellagra. ↑ THIAMIN → NAD

MH065 cobalamin *or* **cobalamine** (*n.*) A vitamin of the B-complex, required by many animals. It is found in animal food products and in fermented food products, but does not occur in any plant products. It contains the metal cobalt in a complex organic compound. The function of cobalamin is to aid cell division and a deficiency affects the division of all cells; this is particularly noticeable in tissues where cells are dividing rapidly, *e.g.* in blood-forming tissues, in the gastro-intestinal tract, and in nervous tissue. In man, abnormal red blood cells, megaloblasts, are formed. A severe deficiency causes megaloblastic anaemia, often accompanied by severe mental disturbance. ↑ THIAMIN

MH066 folic acid (*n.*) A vitamin of the B-complex extracted from spinach and liver; fresh green vegetables and liver are good sources. It functions in many synthetic processes in the body and is a factor with cobalamin in forming normal red blood cells. A severe deficiency causes megaloblastic anaemia and mental disturbance. ↑ THIAMIN

MH067 pantothenic acid (*n.*) A vitamin of the B-complex; required by vertebrates, insects, some bacteria and yeasts. It is widely distributed in plants and animals, so a deficiency in man is unlikely unless processed foods form a large part of the diet. It functions as a coenzyme in glycolysis. No clinical description of a deficiency exists. ↑ THIAMIN

MH068 biotin (*n.*) A vitamin of the B-complex; distributed quite widely except in meat, dairy products, and cereals. It is a very active biochemical substance and forms part of several enzyme systems. Deficiency in man is extremely rare. Induced deficiencies produce symptoms of disease similar to beri-beri. ↑ THIAMIN

MH069 vitamin B_1 (*n.*) Alternative term for THIAMIN. ↓ VITAMIN B_2 · VITAMIN B_6 · VITAMIN B_7 · VITAMIN B_{12} ↑ VITAMIN B-COMPLEX

MH070 vitamin B_2 (*n.*) Alternative term for RIBOFLAVIN. ↑ VITAMIN B_1

MH071 vitamin B_6 (*n.*) Alternative term for PYRIDOXINE. ↑ VITAMIN B_1

MH072 vitamin B_7 (*n.*) Alternative term for NICOTINIC ACID. ↑ VITAMIN B_1

MH073 vitamin B_{12} (*n.*) Alternative term for COBALAMIN. ↑ VITAMIN B_1

MH074 lactoflavin (*n.*) Alternative term for RIBOFLAVIN. ↓ NIACIN · PELLAGRA-PREVENTION FACTOR · P-P FACTOR · CYANOCOBALAMIN · VITAMIN H ↑ VITAMIN B-COMPLEX

MH075 niacin (*n.*) Alternative term for NICOTINIC ACID. ↑ LACTOFLAVIN

MH076 pellagra-prevention factor (*n.*) Alternative term for NICOTINIC ACID. ↑ LACTOFLAVIN

MH077 p-p factor (*n.*) Abbreviation for pellagra-prevention factor. ↑ LACTOFLAVIN

MH078 cyanocobalamin (*n.*) Alternative term for COBALAMIN. ↑ LACTOFLAVIN

MH079 vitamin H (*n.*) Alternative term for BIOTIN. ↑ LACTOFLAVIN

Respiration

MJ001 respiration (*n.*) **1** The process of breathing in which air is pumped through the lungs or water is pumped through the gills. **2** The entire process by which an organism obtains energy from a series of oxidation-reduction reactions on chemical compounds. **3** (Of tissues) to take up oxygen and return excretory products. —***respirometer*** (*n.*) RESPIRE (*v.*) RESPIRATORY, RESPIRED (*adj.*) ↓ EXTERNAL RESPIRATION · CELL RESPIRATION · RESPIRATORY ORGAN · RESPIRE · RESPIRATORY · AEROBIC · STOMA[1] · GILL · TRACHEAL SYSTEM · LUNG → METABOLISM

MJ002 external respiration (*n.*) A process in which oxygen is taken from the environment and carbon dioxide and water are given off into the environment. In protozoans and the lower invertebrates, such as earthworms, molecular oxygen diffuses into the organism and carbon dioxide diffuses out. In aquatic species molecular oxygen is taken from oxygen dissolved in water. In terrestrial species the outer skin or surface must be kept moist for diffusion to take place, *i.e.* oxygen gas dissolves in the film of moisture and then diffuses through the moist skin. In higher organisms a system is needed for the absorption of oxygen and its transport to tissues; two important respiratory organs are lungs and gills. ↓ RESPIRATORY MOVEMENT · RESPIRATORY CENTRE · BREATHING · INSPIRATION · EXPIRATION · EXHALATION · INHALATION ↑ RESPIRATION → GILL · LUNG

MJ003 respiratory movement (*n.*) The body movements that cause a fresh supply of oxygen to be passed on to the respiratory surface, *e.g.* ***a*** (in insects) the dorsal and ventral surfaces are pulled closer together, or the abdomen telescopes, to force stale air out of the tracheal system; on relaxation, fresh air enters; ***b*** (in some crustaceans) appendages bearing gills are waved to pass water over the gills; ***c*** (in fishes) water is taken through the mouth or through a spiracle and the muscles in the pharynx pump it over the gills; ***d*** (in tetrapods) expansion of the chest draws air into the lungs; relaxation of the muscles expels the air; ***e*** (in mammals) chest expansion and flattening of the diaphragm draws air into the lungs; relaxation of the muscles expels the air. ↑ EXTERNAL RESPIRATION

MJ004 respiratory centre (*n.*) A part of the brain in the medulla oblongata which controls the respiratory movement. ↑ EXTERNAL RESPIRATION

MJ005 breathing (*n.*) The action of pumping air in and out of lungs or through tracheae, or pumping water over gills. The focus is on the respiratory movement. —BREATH (*n.*) ***breathe*** (*v.*) ↑ EXTERNAL RESPIRATION

MJ006 inspiration (*n.*) The act or process of taking air or water from the surrounding medium into a respiratory organ. In organisms not possessing respiratory organs, such as earthworms, oxygen diffuses in and there is no inspiration. The focus is on the respiratory process. —***inspired*** (*adj.*) ***inspire*** (*v.*) ↓ EXPIRATION (Cn) · INHALATION (Sn) ↑ EXTERNAL RESPIRATION

MJ007 expiration (*n.*) The act or process of sending air or water out from a respiratory organ. In organisms where there is no inspiration there is no expiration. The focus is on the respiratory process. —***expired*** (*adj.*) ***expire*** (*v.*) ↓ EXHALATION (Sn) ↑ EXTERNAL RESPIRATION · INSPIRATION (Cn)

MJ008 exhalation (*n.*) **1** The action of exhaling, with the focus on the purpose of exhaling, *e.g.* the exhalation of water for the purpose of propulsion in an octopus. **2** The product of exhaling, *e.g.* the exhalation contained obnoxious gases. ↑ EXTERNAL RESPIRATION

MJ009 inhalation (*n.*) The action of inhaling, with the focus on the purpose of inhaling, *e.g.* the inhalation of ether to produce anaesthesia (a state of unconsciousness). ↑ EXTERNAL RESPIRATION

MJ010 cell respiration (*n.*) The process by which all living organisms obtain energy. In plants, the requirement is low; in animals, it is high. In most organisms, energy is obtained from a complicated series of chemical reactions in which molecular oxygen from the atmosphere is used in a cell to oxidize carbohydrates or other organic substances, releasing energy and producing carbon dioxide and water. During the process ADP is changed to ATP, and ATP provides the energy for biological work. In most animal organisms carbohydrate in the diet is digested to glucose and the glucose used for cell respiration. The first stage of cell respiration in organisms is glycolysis. For the next stage, cell respiration can be aerobic or anaerobic. If molecular oxygen is used for oxidation, the amount of energy released is equal to the heat of combustion of glucose. During cell respiration of animals, approximately three-quarters of the energy released is in the form of heat, and one-quarter is used for biological work. The process is part of metabolism. ↓ TISSUE RESPIRATION · INTERNAL RESPIRATION · AEROBE · ANAEROBE · ANOXIA ↑ RESPIRATION → ATP · METABOLISM · GLYCOLYSIS · CYTOCHROME · DEHYDROGENASE

MJ011 tissue respiration (*n.*) Alternative term for CELL RESPIRATION (↑).

MJ012 internal respiration (*n.*) An alternative term for CELL RESPIRATION (↑).

MJ013 aerobe (*n.*) An organism obtaining energy from aerobic cell respiration. ↓ ANAEROBE (Cn) ↑ CELL RESPIRATION → AEROBIC

MJ014 anaerobe (*n.*) An organism

obtaining energy from anaerobic respiration. ↑ CELL RESPIRATION · AEROBE (Cn) → ANAEROBIC

MJ015 anoxia (*n.*) A condition in which the tissues are deficient in oxygen. ↑ CELL RESPIRATION

MJ016 respiratory organ (*n.*) An organ containing a respiratory surface together with supporting and conducting structures, *e.g.* gills, lungs, lung-book, and tracheal system. ↓ RESPIRATORY SURFACE · RESPIRATORY PIGMENT · RESPIRATORY QUOTIENT · RESPIRATORY RATIO ↑ RESPIRATION → GILL · LUNG BOOK

MJ017 respiratory surface (*n.*) The part of a respiratory organ at which oxygen from the surrounding medium is separated from the blood stream by a thin membrane, through which respiratory gases are exchanged by diffusion. In terrestrial animals, the surface is kept moist to dissolve atmospheric oxygen, as only dissolved oxygen can diffuse. ↑ RESPIRATORY ORGAN

MJ018 respiratory pigment (*n.*) A substance capable of combining reversibly with oxygen and which increases the carrying capacity of blood for oxygen. The pigment combines with oxygen in a respiratory organ; blood transports the pigment to the tissues; low oxygen pressure in the tissue decomposes the unstable compound of oxygen and pigment; the reaction is helped by an increase in pH from excreted carbon dioxide. Respiratory pigments change colour when oxygenated, *e.g.* haemoglobin is purple, oxyhaemoglobin is scarlet; haemocyanin is blue when oxygenated, colourless when deoxygenated. Respiratory pigments such as haemocyanin, chlorocruorin, and invertebrate haemoglobin are present in plasma while vertebrate haemoglobin occurs in blood cells. Animals with tracheal systems do not possess respiratory pigments. ↑ RESPIRATORY ORGAN → HAEMOGLOBIN

MJ019 respiratory quotient (*n.*) The ratio of the volume of carbon dioxide expired to the volume of oxygen inspired during the same period. The theoretical respiratory quotient depends on the substrate used in metabolism; for carbohydrate it should be 1, for protein 0·8, and for fat 0·7 ↑ RESPIRATORY ORGAN

MJ020 respiratory ratio (*n.*) Alternative term for RESPIRATORY QUOTIENT. ↑ RESPIRATORY ORGAN

MJ021 respire (*v.i.*) To carry out the full respiratory process of external and internal respiration; to have oxygen diffusing in and internal respiration taking place; to carry out anaerobic respiration, *e.g.* ***a*** seeds can respire aerobically or anaerobically; ***b*** a protozoan respires; ***c*** a mammal respires. ↓ INHALE · EXHALE · SUFFOCATE · INSPIRE (H) EXPIRE (H) ↑ RESPIRATION

MJ022 inhale (*v.t.,i.*) **1** To take in air or other gases or vapours, by expanding the lungs, *e.g.* ***a*** chloroform is inhaled to produce anaesthesia; ***b*** an antiseptic or an antibiotic can be inhaled to reduce or cure respiratory disorders. The focus is on the substance inhaled or the purpose for inhaling. **2** (Of aquatic organisms) to take in water for respiration and other purposes. ***—inhalation,*** INHALENT (*n.*) ***inhaled, inhalant*** (*adj.*) ↓ EXHALE (Cn) · INSPIRE (Sn) ↑ RESPIRE → INSPIRATION

MJ023 exhale (*v.t.,i.*) **1** To expel air or other gases by constricting the lungs; **exhalation** is used to rid the lungs of obnoxious gases. The focus is on the purpose of exhaling. **2** (Of an aquatic organism) to expel water for respiration and other purposes, *e.g.* (in an octopus) for propulsion. ***—exhalation*** (*n.*) ***exhaled,*** EXHALANT (*adj.*) ↓ EXPIRE (Sn) ↑ RESPIRE · · INHALE (Cn)

MJ024 suffocate (*v.t.,i.*) To cause to die or to be killed by stopping respiration through preventing air entering the lungs. ↑ RESPIRE

MJ025 inspire (*v.t.*) To take air or water from the environment into a respiratory organ, with the focus on the process. ↑ RESPIRE

MJ026 expire (*v.t.*) To send air or water from a respiratory tract, with the focus on the process. ↑ RESPIRE

MJ027 respiratory (*adj.*) Of or to do with the process of respiration, *e.g.* respiratory organs, respiratory rate. ↓ RESPIRED · INHALANT[2] (H) · EXHALANT (H)

MJ028 respired (*adj.*) Describes air or water that has passed through a respiratory organ and been expelled to the exterior. ↑ RESPIRATORY

MJ029 inhalant[2] (*adj.*) Of or to do with inhalation, *e.g.* the inhalant siphon of a mollusc which takes in water for feeding and respiration. Contrast **inhalant** and **inhaled**: the siphon is inhalant; the water is the inhaled material. ↓ EXHALANT (Cn) ↑ RESPIRATORY

MJ030 exhalant (*adj.*) Of or to do with exhalation, *e.g.* the exhalant siphon of a mollusc which puts out water by muscular action. To contrast **exhalant** and **exhaled**: exhaled water is pumped out by the exhalant siphon of a mollusc. ↑ RESPIRATORY

MJ031 aerobic (*adj.*) Describes cell respiration in which molecular oxygen from the environment (either gaseous oxygen in air or oxygen dissolved in water) is used to take part in the oxidation of organic substrates. —AEROBE (*n.*) ↓ ANAEROBIC (Cn) · OBLIGATE · FACULTATIVE ↑ RESPIRATION

MJ032 anaerobic (*adj.*) Describes cell respiration in which no oxygen is used to break down organic substrates during metabolism; in plants this process is usually described as fermentation and not respiration. An alternative method of anaerobic respiration, occurring in some bacteria, uses inorganic salts to oxidize organic substrates; this is chemo-organotrophic metabolism and the inorganic salt is reduced, *e.g.* nitrate ions are reduced to nitrite ions. —ANAEROBE (*n.*) ↑ AEROBIC (Cn)

MJ033 obligate (*adj.*) Describes an aerobe or an anaerobe entirely dependent on the

one form of respiration either aerobic or anaerobic respectively. Most animals and many bacteria are obligate aerobes, *i.e.* they are completely dependent on the presence of molecular oxygen for respiration. Obligate anaerobes, such as some bacteria, are usually killed by the presence of molecular oxygen □ *an obligate aerobe* ↓ FACULTATIVE (An) ↑ AEROBIC

MJ034 facultative (*adj.*) Describes an aerobe or an anaerobe which can shift from aerobic to anaerobic respiration or vice-versa. Some bacteria and yeast fungi are facultative aerobes, *i.e.* they thrive in aerobic conditions but can live in anaerobic conditions □ *a facultative aerobe is facultatively aerobic* ↑ AEROBIC · OBLIGATE (An)

MJ035 stoma[1] (*n.,pl.* **stomata**) A small pore in the cuticle and epidermis of a leaf; it allows the exchange of gases between plant tissues and the atmosphere. Stomata are numerous on the underside of leaves and on young stems. In dicotyledons the stomata are scattered all over the surface of the leaf; in many monocotyledons they are arranged in rows parallel to the veins. All stomata allow gaseous exchange for respiration. The stomata in leaves are in addition used for photosynthesis and transpiration. —STOMATAL, STOMATE (*adj.*) ↓ LENTICEL · STOMATAL[1] ↑ RESPIRATION

MJ036 lenticel (*n.*) A small pore, usually elliptical in shape, in the bark of a woody stem; it is formed from cork cells when the epidermis is replaced by cork. It contains loosely packed cells which allow the exchange of gases between the air and the interior of the stem. The gases are exchanged during respiration. ↑ STOMA[1]

MJ037 stomatal[1] (*adj.*) Of, to do with, or like a stoma. ↓ STOMATE[1] ↑ STOMA[1]

MJ038 stomate[1] (*adj.*) Having a stoma or stomata. ↑ STOMATAL[1]

MJ039 gill (*n.*) **1** The respiratory organ of aquatic animals; it consists of thin projections of large surface area, richly supplied with blood vessels and provides the respiratory surface; it is a complex structure open to water and capable of pumping water through the gills. **2** In some aquatic molluscs (bivalves) gills have evolved into large, perforated, ciliated plates of tissue running the length of the mantle cavity and used for feeding as well as for respiration. ↓ INTERNAL GILLS · GILL SLIT · GILL ARCH · GILL FILAMENT · BRANCHIAL · TRACHEAL GILL · CTENIDIUM ↑ RESPIRATION → PULMONARY SAC

MJ040 internal gills (*n.pl.*) Gills formed from projections (gill pouches) from the pharynx; they are inside gill slits and are endodermal in origin; found in most fishes. ↓ EXTERNAL GILLS ↑ GILL[1]

MJ041 external gills (*n.pl.*) Gills formed from epidermis of gill slits; they are ectodermal in origin, found in amphibians, larvae of lung fish, newts, and salamanders. ↑ INTERNAL GILLS

MJ042 gill slit (*n.*) (In fishes and many tetrapod embryos) a vertically elongated slit from the pharynx to the exterior. There are 5 slits in a row on either side of a fish; they are used in respiration in fishes and some amphibians; water is passed from the pharynx through the gill-slit and passes over the gill filaments. In *Amphioxus* and seasquirts, there are many gill slits and their function is to filter off food particles from water passed through them. ↓ GILL BAR · OPERCULUM · GILL POUCH · GILL CLEFT ↑ GILL[1]

MJ043 gill bar (*n.*) (In fishes) tissue separating gill-slits, containing skeletal support for gills and supplied with nerves and blood vessels. ↑ GILL SLIT

MJ044 operculum (*n.*) The cover over the gill slits of bony fishes and some amphibians. (Cartilaginous fishes have exposed gill slits.) ↑ GILL SLIT

MJ045 gill pouch (*n.*) **1** (In all chordate embryos) an oval evagination from the pharynx. A pair of gill pouches corresponds to a segment of the head and there is a series of them with pouches on each side of the pharynx. The gill pouches grow until they come in contact with the mesoderm where gill clefts are formed. Gill pouches break through to the exterior in fishes and some amphibians, forming gills; they break through temporarily in some amphibian larvae but never in terrestrial vertebrates. **2** (In adult lampreys and hagfish, (*Agnatha*)) an alternative term for GILL SLIT, because of their sac-like appearance. ↑ GILL SLIT

MJ046 gill cleft (*n.*) **1** A groove on the ectoderm of embryos, corresponding in position to a gill pouch; it becomes perforated and a passageway is formed with a gill cleft and a gill pouch from the pharynx to the exterior; this develops into a gill slit. **2** An alternative term for GILL SLIT. ↑ GILL SLIT

MJ047 gill arch (*n.*) An arch of bone or cartilage bearing gill filaments; part of the skeleton on one side of the pharynx, it supports a gill bar. There is a gill arch between each two gill slits on either side of a fish. ↓ GILL RAKER · BRANCHIAL ARCH ↑ GILL

MJ048 gill raker (*n.*) A small, needle-like structure of bone attached in a single or double row to the gill arches of bony fish; they prevent food particles from entering the gills. ↑ GILL ARCH

MJ049 branchial arch (*n.*) Alternative term for GILL ARCH (↑).

MJ050 gill filament (*n.*) A delicate thread-like structure arising from a gill arch; on the surface of each filament are many plate-like projections richly supplied with capillaries; they form the respiratory surface of the gill. There is a row of gill filaments on each side of a gill arch. ↓ HEMIBRANCH · HOLOBRANCH · GILL LAMELLA ↑ GILL[1]

MJ051 hemibranch (*n.*) The series of gill filaments on one side of a gill arch. ↑ GILL FILAMENT

MJ052 holobranch (*n.*) The series of gill filaments on both sides of a gill arch. Anterior and posterior hemibranchs form a holobranch ↑ GILL FILAMENT

MJ053 gill lamella (*n.,pl.* **gill lamellae**) Alternative term for GILL FILAMENT (↑).

MJ054 branchial (*adj.*) Of or to do with gills. ↓ BRANCHIATE ↑ GILL[1]

MJ055 branchiate (*n.*) Possessing gills □ *all fishes are branchiate* ↑ BRANCHIAL

MJ056 tracheal gill (*n.*) (In aquatic insect larvae) a small wing-like outgrowth from the abdomen with a thin-walled surface in contact with water; exchange of respiratory gases takes place through the surface. ↓ GILL BOOK · SIPHON[2] ↑ GILL[1]

MJ057 gill book (*n.*) (In some aquatic arachnids) a respiratory organ of corresponding structure to a lung book. ↓ CTENIDIUM ↑ TRACHEAL GILL → LUNG BOOK

MJ058 ctenidium (*n.,pl.* **ctenidia**) (In aquatic molluscs) a comb-shaped or feather-like organ projecting into the mantle cavity from the walls of the cavity; it contains highly vascular tissue and functions as a gill. It can be highly modified for feeding, as in certain bivalves. ↑ GILL BOOK

MJ059 siphon[2] (*n.*) A tubular structure for the intake and output of water, found in aquatic organisms and performing various functions, including respiration. ↓ SWIM BLADDER ↑ TRACHEAL GILL

MJ060 swim bladder (*n.*) (In bony fish) a bladder containing air or gas situated in the roof of the abdominal cavity. It functions as an organ varying the relative density of the fish to match the relative density of the water in which the fish is swimming. It enables the fish to remain at any depth without effort. It develops from a primitive lung, as a diverticulum of the gut. In lung fish it functions as a respiratory organ. ↑ SIPHON[2]

MJ061 tracheal system (*n.*) (In insects) a system of branching tubes carrying air from spiracles to all tissues in the body. A tracheal system limits the size of insects as air cannot diffuse efficiently for a long distance along a tube. The tubes are lined with spiral thickenings of chitin. Contraction of abdominal muscles expels air (expiration); relaxation of the muscles allows air to diffuse in (inspiration). ↓ TRACHEA[2] · SPIRACULAR ↑ RESPIRATION

MJ062 trachea[2] (*n.,pl.* **tracheae**) A tube of a tracheal system; tracheae ramify throughout the body of an insect and are formed from epidermis and chitin. Each terminates in an end cell; some are connected to air-sacs. —***tracheal*** (*adj.*) ↓ TRACHEOLE · SPIRACLE · STIGMA[2] ↑ TRACHEAL SYSTEM → AIR-SAC

MJ063 tracheole (*n.*) A terminal branch of a tracheal system. It leads from an end cell and ends blindly in a tissue, or in some cases it ends intracellularly. It has no lining of chitin; oxygen and carbon dioxide diffuse in opposite directions through its thin walls during respiration. A tracheole is 1 μm in diameter, or less. ↑ TRACHEA[2]

MJ064 spiracle (*n.*) **1** The external opening of a trachea in a larval or adult insect, it can be closed by valves. **2** (In cartilaginous fishes) a small opening situated dorsally to and in front of the first gill slit. It is a vestige of a primitive gill slit. Inspiration takes place mainly through the spiracle. In bony fish the spiracle is closed. In tetrapod embryos the spiracle is represented by a gill pouch which develops into the middle ear and Eustachian tube. —SPIRACULAR (*adj.*) SPIRACULATE (*adj.*) ↑ TRACHEA[2]

MJ065 stigma[2] (*n.,pl.* **stigmata**) (In adult insects) alternative term for SPIRACLE · ↑ TRACHEA[2]

MJ066 spiracular (*adj.*) Of or to do with a spiracle. ↓ SPIRACULATE ↑ TRACHEAL SYSTEM

MJ067 spiraculate (*adj.*) Possessing spiracles, *e.g.* caterpillars are spiraculate. ↑ SPIRACULAR

MJ068 lung (*n.*) A respiratory organ of many terrestrial animals. In vertebrates it arises in the embryo as a diverticulum of the gut. In bony fish it develops into a swim-bladder; in lung-fish it remains as a primitive functional lung. In amniotes and amphibians the lungs are paired and connected to the pharynx. In terrestrial molluscs it is a vascular part of the mantle cavity, richly supplied with blood vessels. ↓ TRACHEA[1] · ALVEOLUS · PLEURA · DIAPHRAGM[1] · PNEUMONIA · PULMONARY · LUNG BOOK · BREATH · LARYNX ↑ RESPIRATION → SWIM BLADDER · PULMONARY SAC

MJ069 trachea[1] (*n.,pl.* **tracheae**) (In tetrapods) a tube leading from the pharynx to its junction with two bronchi. Its walls contain C-shaped plates of cartilage to prevent it collapsing and it is lined with ciliated epithelium. —***tracheal*** (*adj.*) ↓ BRONCHUS · BRONCHIA · BRONCHIOLE · WIND-PIPE · RESPIRATORY TRACT ↑ LUNG → GLOTTIS · LARYNX

MJ070 bronchus (*n.,pl.* **bronchi**) (In tetrapods) a tube connecting the trachea to one lung; there are two bronchi, one to each lung. Within the lung the bronchi branch repeatedly. A bronchus has C-shaped plates of cartilage, smooth muscles and mucous-secreting glands in its walls; the epithelial cells bear cilia which beat towards the pharynx removing foreign particles in a stream of mucus as phlegm. —BRONCHIAL (*adj.*) ↑ TRACHEA[1] → CILIUM

MJ071 bronchia (*n.pl.*) The branches of a bronchus situated within a lung. ↑ TRACHEA[1]

MJ072 bronchiole (*n.*) (In tetrapods) a small tube, of diameter 0·5 mm–1·0 mm, conducting air from branches of the bronchi to alveoli. The walls contain smooth muscle capable of altering the size of the lumen; they do not contain cartilage or mucous glands. ↑ TRACHEA[1]

MJ073 wind-pipe (*n.*) (G.S.) Alternative term for TRACHEA[1] (↑).

MJ074 respiratory tract (*n.*) All the conducting structures associated with respiration in air, from the nose to the alveoli. ↑ TRACHEA[1]

MJ075 alveolus (*n.,pl.* **alveoli**) **1** (In vertebrates) a small, thin-walled membranous sac, covered with a network of capillaries,

situated at the terminal end of a bronchiole. It provides a respiratory surface in a lung; there are large numbers of alveoli in a lung and in man the surface area of all the alveoli is approximately 100 m^2. **2** A socket in the jaw-bone in which mammalian teeth fit. **3** An expanded sac at the terminal end of a duct in many secretory glands; the walls of the alveolus contain glandular epithelium. —***alveolar*** (*adj.*) ↓ ALVEOLAR SAC · ALVEOLAR DUCT ↑ LUNG → GLAND

MJ076 alveolar sac (*n.*) An alveolar duct terminates in an alveolar sac; the individual alveoli are pouches in the walls of the alveolar sac. ↑ ALVEOLUS

MJ077 alveolar duct (*n.*) Terminal bronchioles divide into alveolar ducts; the ducts are short tubes entering an alveolar sac. ↑ ALVEOLUS

MJ078 pleura (*n.,pl.* **pleurae**) (In mammals) a serous membrane lining the thoracic cavity (the **parietal pleura**) or surrounding the lung (the **pulmonary pleura**). There are two pleurae associated with each lung; they are separated by a pleural cavity. —***pleural*** (*adj.*) ↓ PLEURAL SAC · PLEURAL CAVITY[1] · MEDIASTINUM ↑ LUNG → SEROUS

MJ079 pleural sac (*n.*) A sac containing a lung and surrounded by a pleura; there are two pleural sacs separated by the pericardial sac and the mediastinum. It is a coelomic space separated from the perivisceral sac by the diaphragm; found only in mammals. ↑ PLEURA → PERICARDIAL CAVITY

MJ080 pleural cavity[1] (*n.*) The space between the pulmonary pleura and the parietal pleura. In the normal state it contains a little serous liquid which lubricates the surfaces of the pleurae and prevents friction during respiratory movements. ↑ PLEURA

MJ081 mediastinum (*n.*) A median dorsoventral extended cleft between the pleural sacs of a mammal. It contains the pericardial sac, trachea, oesophagus, aorta, and other structures. ↑ PLEURA

MJ082 diaphragm[1] (*n.*) (In mammals) a dome-shaped sheet of tissue, part muscle, part tendon, separating the thoracic and abdominal cavities; it is covered by a serous membrane. At rest it is arched up into the thoracic cavity; with muscular contraction it flattens, increasing the volume of the thoracic cavity and causing inspiration. In most mammals it is the most important structure for inspiration. ↓ INTERCOSTAL MUSCLE ↑ LUNG

MJ083 intercostal muscle (*n.*) One of the muscles situated between the ribs; when these muscles contract they raise the ribs, increasing the volume of the thoracic cavity, and so cause atmospheric pressure to drive air into the lungs. ↑ DIAPHRAGM[1]

MJ084 pneumonia (*n.*) Any disease causing inflammation of the lung, particularly by bacterial infection from *Pneumococcus*. ↓ BRONCHITIS · PLEURISY ↑ LUNG

MJ085 bronchitis (*n.*) Inflammation of the bronchi ↑ PNEUMONIA

MJ086 pleurisy (*n.*) Inflammation of the pleura or pleurae; usually accompanied by an accumulation of liquid in the pleural cavity. ↑ PNEUMONIA

MJ087 pulmonary (*adj.*) Of or to do with the lungs, *e.g.* the pulmonary artery running to the lungs. ↓ BRONCHIAL ↑ LUNG

MJ088 bronchial (*adj.*) Of or to do with the bronchi. ↑ PULMONARY

MJ089 lung book (*n.*) (In some air-breathing arachnids, such as spiders and scorpions) a respiratory organ consisting of projections arranged like the leaves of a book; the lung-book is in a depression of the body wall and is filled with blood. ↓ PULMOBRANCHIA · PULMONARY SAC · PULMOBRANCHIAL ↑ LUNG

MJ090 pulmobranchia (*n.*) Alternative term for LUNG BOOK. —PULMOBRANCHIAL, PULMOBRANCHIATE (*adj.*) ↑ LUNG BOOK

MJ091 pulmonary sac (*n.*) (In slugs and snails) an adaptation of the mantle cavity forming a respiratory organ; a network of capillaries in the walls of the mantle cavity forms a highly vascular surface and the entrance to the cavity is narrowed and contractile. ↓ AIR SAC ↑ LUNG BOOK → CTENIDIUM

MJ092 air-sac (*n.*) **1** (In birds) one of the thin-walled, air-filled accessory vessels connected with lungs, situated mainly in the thoracic and abdominal cavities but extending even into hollows in some of the bones. Their function is to help respiration during flight by acting as pumps to drive stale air out of the alveoli. **2** (In insects) a thin-walled dilation or diverticulum of a trachea; its function is the same as in birds. ↑ PULMONARY SAC → TRACHEA[1,2]

MJ093 pulmobranchial (*adj.*) Of or to do with pulmobranchia. ↓ PULMOBRANCHIATE ↑ LUNG BOOK

MJ094 pulmobranchiate (*adj.*) Possessing a pulmobranchia as a respiratory organ. ↑ PULMOBRANCHIAL

MJ095 breath (*n.*) **1** A single instance of taking air into the lungs and expelling it. **2** The air expelled from the lungs. ↓ RESPIRATORY RATE · TIDAL AIR · PHLEGM · HALITOSIS · EXPECTORATE · STALE ↑ LUNG

MJ096 respiratory rate (*n.*) The number of breaths per minute; for a man it is about 18. The rate is increased by a high concentration of carbon dioxide in the blood and also by hormones ↑ BREATH → ADRENALIN

MJ097 tidal air (*n.*) The air entering and leaving the lungs during normal respiration; in man the volume is about 500 cm^3. ↓ COMPLEMENTAL AIR · SUPPLEMENTAL AIR · VITAL CAPACITY · RESIDUAL AIR ↑ BREATH

MJ098 complemental air (*n.*) The increase in volume of air above tidal air to completely fill the lungs; in man about 2500 cm^3. ↑ TIDAL AIR

MJ099 supplemental air (*n.*) The decrease in volume below tidal air to empty the lungs by forced expiration; in man about 1000 cm^3. ↑ TIDAL AIR

MJ100 vital capacity (*n.*) The largest

change in volume that can be made by the lungs from filling them completely to emptying them by forced expiration, *i.e.* complemental air + tidal air + supplemental air; in man about 4000 cm^3. ↑ TIDAL AIR

MJ101 residual air (*n.*) Even with forced expiration, the lungs cannot be emptied completely; the remaining air is called residual air and in man has a volume of about 1000 cm^3. ↑ TIDAL AIR

MJ102 phlegm (*n.*) Mucus containing foreign particles, whether dust or other foreign bodies; it is carried up the respiratory tract by the beating movement of cilia to the pharynx, where it is coughed into and out of the mouth. ↓ EXPECTORANT ↑ BREATH → MUCUS

MJ103 expectorant (*n.*) A drug used to induce expectoration, administered in cases of certain respiratory disorders. ↓ EXPECTORATE ↑ PHLEGM

MJ104 halitosis (*n.*) Bad-smelling breath, usually caused by stomach disorders. ↑ BREATH

MJ105 expectorate (*v.i.*) To expel phlegm and mucus from the respiratory tract, by spitting it out. —EXPECTORANT (*n.*) ↑ BREATH

MJ106 spit (*v.t.,i.*) To eject liquid from the mouth. The term is not used in scientific descriptions. —***spittle*** (*n.*) ↑ EXPECTORATE

MJ107 stale (*adj.*) Describes air that has been breathed, *e.g.* ***a*** air in the alveoli is not completely removed with every breath (residual air) and some stale air remains; ***b*** a closed room with people in it contains stale air which has been breathed many times. Stale air contains a higher percentage of carbon dioxide and water vapour and a lower percentage of oxygen. —***staleness*** (*n.*) ↑ BREATH

MJ108 larynx (*n.,pl.* **larynges**) (In reptiles, mammals and some amphibians) a swelling of the trachea just at the opening into the pharynx. It possesses plates of cartilage in its walls and muscles which open and close the glottis. It is the organ where vocal sounds are produced. —LARYNGEAL (*adj.*) ↓ VOCAL CORD · SYRINX · LARYNGITIS · LARYNGEAL → LUNG

MJ109 vocal cord (*n.*) One of the dorsoventral folds of mucous membrane projecting into the lumen of the larynx. Vibrations of the vocal cords produce vocal sounds. The vocal cords are stretched by muscles attached to cartilaginous plates in the larynx to alter the pitch of the voice. ↓ STRIDULATION ↑ LARYNX

MJ110 stridulation (*n.*) The production of sound by rubbing one part of the body (the **scraper**) against another part (the **file**); it occurs in certain insects. In some grasshoppers the hind leg is the scraper, veins on the wing the file; other grasshoppers rub their wings together. Generally only males stridulate; it is considered to be a mating call. —***stridulate*** (*v.*) ↑ VOCAL CORD

MJ111 syrinx (*n.,pl.* **syringes**) (In birds) the organ where vocal sounds are produced; it is situated at the base of the trachea where the bronchi join the trachea. —***syringeal*** (*adj.*) ↑ LARYNX

MJ112 laryngitis (*n.*) Inflammation of the larynx. ↑ LARYNX

MJ113 laryngeal (*adj.*) Of or to do with the larynx. ↓ VOCAL ↑ LARYNX

MJ114 vocal (*adj.*) Of or to do with the voice or the production of sounds by animals using their respiratory tract. ↑ LARYNGEAL

Work

NA001 work (*n.*) Mechanical work is done when a force moves its point of application; it is measured by the magnitude of the force multiplied by the distance moved in the direction in which the force acts. If a force, F, moves its point of application through a distance, s, and θ is the angle between the line of action of the force and the displacement, then the work done (w) is given by:

$$w = F \cos \theta s$$

If a torque, T, rotates a body through an angle θ, the work done is:

$$w = T\theta$$

Work is done in compressing a gas or a spring; stretching an elastic body; deforming a solid; in twisting a wire. Work is done when one form of energy is transformed into another form of energy, *e.g.* in an internal combustion engine, the chemical energy of petrol is transformed into kinetic energy (by way of heat energy) and work has been done. Work, like energy, is measured in joules. ↓ POWER · LEVER · PULLEY · SCREW · DIFFERENTIAL · ENGINE

NA002 power (*n.*) Power is the rate of transfer of energy, or the rate of doing work. The symbol for power is P.

$$P = \frac{\text{work done}}{\text{time taken}} = \frac{w}{t}$$

Power is measured in watts. ↓ PERFECT MACHINE · IMPERFECT MACHINE · EFFORT · LOAD · MECHANICAL ADVANTAGE · VELOCITY RATIO · EFFICIENCY ↑ WORK → WATT

NA003 perfect machine (*n.*) A machine in which no energy is wasted in overcoming friction or other undesirable effects. ↑ POWER

NA004 imperfect machine (*n.*) A machine in which energy is wasted by friction and other effects. All machines in practical use are imperfect machines. ↑ POWER

NA005 effort (*n.*) The force applied to a lever, or to any machine. ↑ POWER

NA006 load (*n.*) The force overcome by a lever, or by any machine. ↑ POWER

NA007 mechanical advantage (*n.*) The ratio of the load to the effort for a lever, or any machine.

$$\text{M.A.} = \frac{\text{load}}{\text{effort}}$$

↑ POWER

NA008 velocity ratio (*n.*) In a machine, the ratio of the distance moved by the effort to the distance moved by the load. In most machines operated by hand, the effort moves much further than the load during the same time.

$$\text{V.R.} = \frac{\text{distance effort moves}}{\text{distance load moves}}$$

↑ POWER

NA009 efficiency (*n.*) (Of a machine) the ratio of the work done by the machine to the ratio of the work put into the machine. It is expressed as a percentage and is always less than 100% for machines in general use.

$$\text{Efficiency} = \frac{\text{output}}{\text{input}} \times 100\%$$

↑ POWER → THERMAL EFFICIENCY · MECHANICAL EFFICIENCY

NA010 lever (*n.*) A rod, bar, or other rigid body, which is supported by, and turns on, a fulcrum. A force is applied at one point on the lever to overcome a force at some other point on the lever. The action of a lever is based on the principle of moments. —LEVERAGE (*n.*) ↓ FULCRUM · ORDER OF A LEVER · LEVERAGE · AXLE[1] · BEARING[2] · WHEEL AND AXLE ↑ WORK

NA011 fulcrum (*n.*) The point of support of a lever, about which the lever turns. ↑ LEVER

NA012 order of a lever (*n.*) One of three possible classes of lever, depending on the relative positions of the load, fulcrum, and effort: **first order** fulcrum between load and effort—mechanical advantage can have any value; **second order** load between fulcrum and effort—mechanical advantage is always greater than unity; **third order** effort between load and fulcrum—mechanical advantage is always less than unity. ↑ LEVER

NA013 leverage (*n.*) **1** The mechanical advantage of a lever. **2** The abstract concept of the mechanical advantage in moving loads. ↑ LEVER

NA014 axle[1] (*n.*) A rod on which a wheel is mounted; the wheel may rotate round the axle, or the axle and wheel may be fixed together so that the axle rotates with the wheel. ↑ LEVER

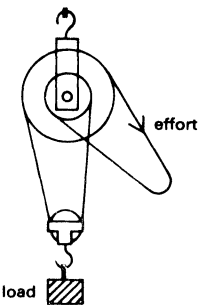
NA015 bearing[2] (*n.*) A support for an axle, particularly when the axle rotates with the wheel; a support for any rotating rod. ↑ LEVER

NA016 wheel and axle (*n.*) A simple machine using a thick axle fixed to a wheel. The effort is applied to the wheel and a rope or cord round the axle lifts the load. Practical examples of the wheel and axle include the windlass and the capstan. ↑ LEVER

NA017 pulley (*n.*) A small wheel, fixed on an axle, free to rotate in a frame. The wheel has a groove to take a rope or chain. A pulley is used, ***a*** to change the direction of application of a tension; ***b*** in pulley machines, for obtaining a mechanical advantage. ↓ PULLEY SYSTEM · BLOCK AND TACKLE · DIFFERENTIAL PULLEY ↑ WORK

NA018 pulley system (*n.*) A set of pulleys interconnected by cords, ropes or chains, to form a machine; different combinations of pulleys form different systems. ↑ PULLEY

NA019 block and tackle (*n.*) One or more pulleys mounted in a frame (the block) together with ropes or chains forming a pulley system used for raising a load. An upper block is fixed to a support and the lower block is attached to a load. A continuous rope is passed round all the pulleys, alternately one in the top block and one in the lower block, and the effort is applied to the free end of the rope—this raises the load. ↑ PULLEY



DIFFERENTIAL PULLEY

NA020 differential pulley (*n.*) Two pulley wheels of different diameter, fixed together and mounted in one block. One pulley lowers a loop of rope or chain; the other pulley raises the loop. One rotation of the pulley wheels shortens the loop and raises a load attached to the bottom of the loop. The rope is continuous, forming two loops suspended from the pulleys. ↑ PULLEY

NA021 screw (*n.*) **1** A metal peg with a spiral groove cut in it and a head with a slot. It is used to join pieces of wood, etc., by twisting the screw under pressure to enter the material. **2** A machine which uses a spiral groove on a rod to move the rod through a nut to obtain a mechanical advantage. A turning force (the effort) is applied through a bar at one end of the rod, and for one rotation of the bar, the rod advances by a distance equal to the pitch of the screw, pushing the load before it. The screw is used in devices such as a car jack and a vice. —***screw*** (*v.*) ↓ THREAD · PITCH[1] · INCLINED PLANE ↑ WORK

NA022 thread (*n.*) The spiral groove cut in a screw. ↑ SCREW

NA023 pitch[1] (*n.*) The distance between two adjacent grooves of the thread of a screw ↑ SCREW

NA024 inclined plane (*n.*) A plane surface, such as a plank, inclined at an angle to the horizontal. A load is pushed or rolled up the inclined plane. The velocity ratio of the inclined plane is equal to the sine of the angle of inclination. ↑ SCREW

NA025 differential (*adj.*) Describes any device in which two movements or motions opposing each other produce a resultant motion which is the difference between them. ↑ WORK

NA026 engine (*n.*) A device for transforming heat energy into mechanical energy, as in a steam engine or a petrol engine. ↓ MOTOR[1] · WORKING FLUID · PISTON · TURBINE · REFRIGERANT · EXHAUST[3] · MECHANICAL[2] ↑ WORK

NA027 motor[1] (*n.*) A device for transforming one form of energy into the kinetic energy of motion. An electric motor transforms electrical energy into kinetic energy of motion. ↓ LOCOMOTIVE · INTERNAL-COMBUSTION ENGINE · DIESEL ENGINE · MACHINERY · AXLE[2] · BEARING[1] ↑ ENGINE

NA028 locomotive (*n.*) A vehicle mounted with an engine. Power is supplied by a steam engine, diesel engine, electric motor, etc. ↑ MOTOR[1]

NA029 internal-combustion engine (*n.*) An engine which burns hydrocarbon fuels to supply heat energy. Vaporized hydrocarbon is exploded by a spark in a petrol engine; the energy released in the explosion is transformed by a piston and crankshaft into rotary mechanical energy. The combustion occurs inside the engine. ↑ MOTOR[1]

NA030 diesel engine (*n.*) A type of internal-combustion engine in which oil is mixed with air and compressed by a piston in a cylinder. The compression heats the mixture above the ignition temperature of the oil. The oil burns rapidly and heat expands the gaseous products; the pressure of these products forces the piston down the cylinder. ↑ MOTOR[1]

NA031 machinery (*n.*) **1** The interconnecting parts, usually made of metal, of which a complex machine is made. **2** A collective term for machines in general. ↑ MOTOR[1]

NA032 axle[2] (*n.*) A supported rod, on which a wheel turns; if it is a **fixed axle**, the wheel and axle turn together. The axle can also support the wheel, as in some machinery parts. ↑ MOTOR[1]

NA033 bearing[1] (*n.*) A fixed support in which an axle or a rod rotates, used in machinery, engines, and motors ↑ MOTOR[1]

NA034 working fluid (*n.*) A liquid or a gas used in an engine; the properties of the fluid are utilized in producing mechanical movement. Water, or steam, is the working fluid in a steam engine. ↓ EXHAUST[4] · THERMAL EFFICIENCY · MECHANICAL EFFICIENCY · INDICATED POWER · BOILER · CONDENSER ↑ ENGINE

NA035 exhaust[4] (*n.*) **1** The current of waste or used gaseous products removed from an engine **2** The outlet pipe through which gaseous products pass. —EXHAUST (*v.*) ↑ WORKING FLUID

NA036 thermal efficiency (*n.*) (Of an engine) the ratio of the useful work done by the engine to the calorific value of the fuel consumed in doing this work,

i.e. $\dfrac{\text{useful work}}{\text{calorific value of fuel}}$.

↑ WORKING FLUID

NA037 mechanical efficiency (*n.*) (Of an engine) the ratio of the useful power supplied by an engine to the indicated power of the engine,

i.e. $\dfrac{\text{useful power}}{\text{indicated power}}$.

↑ WORKING FLUID

NA038 indicated power (*n.*) The working fluid of an engine applies force to a piston; the average force exerted, multiplied by the length of the stroke, is the indicated power for a double-acting piston. ↑ WORKING FLUID

NA039 boiler (*n.*) A device for changing large quantities of water into steam. ↑ WORKING FLUID

NA040 condenser (*n.*) A device for condensing steam to water in an engine. It assists the action of a steam engine or a turbine by creating a vacuum which moves the piston, *i.e.* if pressure pushes the piston down, the vacuum pulls the piston up and aids the oscillatory motion. ↑ WORKING FLUID

NA041 piston (*n.*) A part of an engine which is driven up and down, or backwards and forwards; it consists of a round plate, or a small cylinder, articulating with a piston rod. It is mounted inside a cylinder. Pressure on the piston causes it to move in one direction and other machinery parts return it in the other direction. A piston thus oscillates inside its cylinder. A piston, piston rod, and crankshaft, transform heat energy through an oscillatory motion into kinetic energy of rotation. ↓ CYLINDER · PORT · STROKE · CRANK · CRANKSHAFT · MANIFOLD · GEAR · GEAR WHEEL · COG WHEEL · COG ↑ ENGINE

NA042 cylinder (*n.*) (In an engine or a pump) a cylindrical vessel in which a piston moves up and down; it is provided with ports. ↑ PISTON

NA043 port (*n.*) A hole in a cylinder for allowing the working fluid to enter or allowing the exhaust to leave. ↑ PISTON

NA044 stroke (*n.*) **1** The distance covered by a piston moving in one direction only to the full extent permitted. **2** (Of a piston) a motion of this kind. ↑ PISTON

NA045 crank (*n.*) A rod or arm at right angles to a shaft; an attachment at the end of the crank allows an up-and-down motion to be transformed into a rotary motion of the shaft. ↑ PISTON

NA046 crankshaft (*n.*) A shaft driven by a crank. ↑ PISTON

NA047 manifold (*n.*) A large tube with openings to admit other tubes. An example is the inlet manifold of a petrol engine with

pipes leading to the ports of each cylinder. ↑ PISTON

NA048 gear (*n.*) A system of moving parts used to pass movement or motion from one point to another, *e.g.* ***a*** the gear which connects the moving blades of a turbine with the axle of a generator in a power station; ***b*** the gears which connect an internal combustion engine with the driving wheels of a motor car. ↑ PISTON

NA049 gear wheel (*n.*) A wheel in a gear. In most gears the moving parts are gear wheels mounted on axles, and are usually cog wheels. ↑ PISTON

NA050 cog wheel (*n.*) A wheel with teeth round its edge. The teeth engage with the teeth of another cog wheel, so that when one wheel turns, it drives another wheel. Cog wheels are used extensively in gears and in mechanisms on machinery for transmitting movement from one point to another, *e.g.* ***a*** the gear wheels in a motor car are cog wheels; ***b*** cog wheels are used in the mechanism of a clock so that the power stored in a coiled spring is used to drive the hands of the clock or watch. ↑ PISTON

NA051 cog (*n.*) One tooth of a cog wheel. ↑ PISTON

NA052 turbine (*n.*) A type of engine in which a current of steam, or other gas, is directed against a set of propellor blades mounted on a shaft. The kinetic energy of the steam is given to the propellors and the shaft is rotated at high speed. ↓ ROTOR · STATOR · NOZZLE · CASING ↑ ENGINE

NA053 rotor (*n.*) The propellor blades and shaft which rotate in a turbine. ↑ TURBINE

NA054 stator (*n.*) The casing surrounding the rotor in a turbine. It has projections which are shaped like propellor blades. These projections direct steam onto the rotor at the correct angle for maximum efficiency. ↑ TURBINE

NA055 nozzle (*n.*) A short pipe attached to a long tube acting as an outlet for a stream of fluid. It is used to direct a stream of fluid at a particular point. ↑ TURBINE

NA056 casing (*n.*) The outer cover of machinery. It is almost always made of metal. ↑ TURBINE · MACHINERY

NA057 refrigerant (*n.*) A suitable fluid for use in a refrigeration cycle. Refrigerants are volatile liquids which vaporize at a low temperature. ↓ REFRIGERATION CYCLE · REFRIGERATOR ↑ ENGINE

NA058 refrigeration cycle (*n.*) A cycle of operations used in refrigeration. A vaporized refrigerant is pumped under pressure to a condenser. The hot vapour is cooled below its boiling point and condenses to liquid. Liquid under pressure leaves the condenser and expands rapidly through a narrow orifice and vaporizes, taking the latent heat of vaporization from a cold chamber. The vapour at low pressure is removed by a pump and compressed; the cycle then starts again. ↑ REFRIGERANT

NA059 refrigerator (*n.*) A device that uses a refrigeration cycle to produce coldness for the storage of food. ↑ REFRIGERANT

NA060 exhaust[3] (*v.t.*) To remove waste or used gaseous products from an engine, especially from the cylinder of a piston. ↓ MOUNT[2] ↑ ENGINE

NA061 mount[2] (*v.t.*) To support an object, especially a piece of machinery or an instrument, by securing it to the support. The focus is on the accurate positioning of the object on its support (or **mounting**), *e.g.* ***a*** the mounting of a specimen on a microscope slide; ***b*** to mount an armature inside a field coil of an electric motor. —***mounting*** (*n.*) ***mounted*** (*adj.*) ↑ EXHAUST[3]

NA062 mechanical[2] (*adj.*) Of or to do with machines, engines or motors; the term also implies a process continuing without control by an individual. ↓ SUPERHEATED[2] · SINGLE-ACTING · DOUBLE ACTING ↑ ENGINE

NA063 superheated[2] (*adj.*) Describes steam at a temperature well above 100°C. ↑ MECHANICAL

NA064 single acting (*adj.*) Describes a piston in which pressure from a working fluid acts on one side only of the piston. ↑ MECHANICAL

NA065 double acting (*adj.*) Describes a piston in which pressure from a working fluid acts alternately on both sides of a piston. ↑ MECHANICAL

Wave Motion

NB001 wave (*n.*) **1** A disturbance which passes on energy through a material medium by means of the elastic and inertial characteristics of the medium. The disturbance causes displacement of the particles of the medium, the particles returning to their position of rest after the disturbance has passed. The displacement of a particle follows a pattern of oscillation about its position of rest, and passing through its position of rest; it oscillates from side to side, with its displacement being relatively small. The disturbance is passed on from particle to particle by the elasticity of the medium, and the inertial characteristics of the medium help to determine the speed with which the energy is passed on. Waves on the sea are a simple example; a boat rises and falls with the waves, but does not travel with them. **2** A disturbance which passes on energy through empty space by variations in the electric and magnetic properties of

space. The electric and magnetic fields at a particular point in space increase and decrease regularly. Transmission of energy in this way is by an electromagnetic wave □ *a wave travels from its source to a point; the path of a wave is the direction it follows* ↓ WAVE MOTION · PENCIL · WAVELENGTH · MEDIUM[1] · SINUSOIDAL → INTERFERENCE[2] · POLARIZATION[2] · OSCILLATION · PENDULUM · ELECTROMAGNETIC RADIATION · RADIO WAVES · RADAR · COSMIC RAYS · RADIO FREQUENCY RADIATION · QUANTUM THEORY

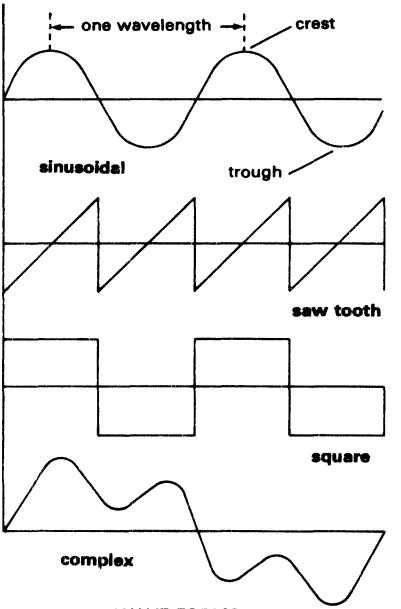
NB002 wave motion (*n.*) The transmission of energy through a medium by the forward movement of waves. In a material medium the particles do not move forward, only the disturbances, represented by waves, move forward. The essential characteristics of wave motion are interference and diffraction; these differentiate the transference of energy by wave motion from the transference of energy by a stream of particles. Transverse wave motion can be polarized; longitudinal wave motion cannot be polarized □ *a wave motion is propagated by transverse waves* ↓ TRANSVERSE WAVE MOTION · LONGITUDINAL WAVE MOTION · WAVE FORM · CREST[2] · TROUGH · AMPLITUDE[1] · INTENSITY[1] ↑ WAVE

NB003 transverse wave motion (*n.*) **1** A form of transference of energy in which disturbances of the particles in a material medium displace the particles in a direction at right angles to the direction of propagation. **2** Electromagnetic waves are transmitted in space, or in a material medium, by transverse waves. In either case, disturbances of the medium produce variations in the electric and magnetic properties of the medium which are both at right angles to the direction of propagation and at right angles to each other. ↑ WAVE MOTION

NB004 longitudinal wave motion (*n.*) A form of transference of energy in which disturbances of particles in a material medium displace the particles in the same direction as that of propagation, *e.g.* sound waves are longitudinal waves, with alternating regions of compression and rarefaction. ↑ WAVE MOTION → COMPRESSION · RAREFACTION

NB005 wave form (*n.*) The curve of an alternating displacement plotted against time. In the case of a transverse wave, it is the plot of the disturbances of the particles in a material medium. It is also the projection of the pressures in a longitudinal wave in a material medium. The simplest wave form is a sinusoidal curve, which is a sine curve. Other wave forms can be obtained; they include a saw-tooth wave, a square wave, and other complex wave forms. (See diagram above.) ↑ WAVE MOTION

NB006 crest[2] (*n.*) The position of maximum displacement or disturbance in a wave. In a graph of the wave form, it is the upper limit of the curve of a wave. A regular wave motion consists of a number of equidistant crests. ↓ TROUGH (P) ↑ WAVE MOTION



WAVE FORMS

NB007 trough (*n.*) The position of maximum displacement or disturbance opposite to the displacement at a crest. A trough exists between any two crests of a regular wave motion. It is one of the points at which the wave form has a minimum value. ↑ WAVE MOTION · CREST[2] (P)

NB008 amplitude[1] (*n.*) The maximum displacement, on either side of a mean position, of an oscillating particle, *e.g.* the amplitude of a pendulum is half the length of its swing; in a wave it is the displacement between the rest or zero position and a crest (or a trough). In wave motion it is the displacement of a particle in a material medium or the electrical or magnetic displacement for an electromagnetic wave in a material medium or in free space. The amplitude of a wave motion determines the amount of energy carried by a wave. ↑ WAVE MOTION

NB009 intensity[1] (*n.*) The quantity of energy, carried by a wave motion, passing per unit solid angle in unit time. It is measured in watts per steradian ($W\ sr^{-1}$). The symbol for intensity is *I*. —***intense*** (*adj.*) ↑ WAVE MOTION

NB010 pencil (*n.*) A slender cylinder or cone of rays which passes through an optical system; the term is limited to describing light rays. The pencil of rays is limited in diameter by an aperture. The chief ray of the pencil is the central ray, and it passes through the centre of the aperture and the centre of the pupil of the eye. Pencils of rays can be diverging from a point or converging to a point, or can consist of parallel rays. ↓ BEAM[2] · WAVE TRAIN · WAVE GROUP · WAVE

PACKET · PHASE[1] · PHASE ANGLE · PHASE DIFFERENCE ↑ WAVE

NB011 beam[2] (*n.*) A collection of pencils of rays forms a beam of light. It can be composed of parallel rays, divergent rays, or convergent rays. A beam of any electromagnetic radiation is similar to a beam of light. ↑ PENCIL

NB012 wave train (*n.*) A succession of groups of waves travelling in the same direction and originating from the same source. ↑ PENCIL

NB013 wave group (*n.*) A system of waves in which the amplitude dies away on either side of a centre of maximum disturbance. Such a group can arise from the superposition of two sinusoidal waves of slightly different wavelengths, and therefore of different velocities if the medium is a dispersive one. ↑ PENCIL

NB014 wave packet (*n.*) A wave group in which the amplitude dies away very quickly with distance. Thus it acts as a small packet of waves, containing only a few vibrations. A wave packet can behave as a particle in some circumstances, *e.g.* a photon of electromagnetic radiation can be thought of as a wave packet. ↑ PENCIL

NB015 phase[1] (*n.*) Particles, or points, in the path of a wave motion, are said to be in phase if their displacements are of the same magnitude and the particles, or points, are travelling in identical directions. If two waves are travelling in the same direction and their crests coincide in time, the waves are in phase. Any two waves not in phase are said to be out of phase □ *any two waves can be in phase, or out of phase; two waves can differ in phase by a stated angle* ↑ PENCIL

NB016 phase angle (*n.*) A periodic motion can be represented by a point travelling round a circle, starting at an angle of 0° and completing one period at an angle of 360°. A sinusoidal wave motion in this representation is at zero amplitude for 0°, at a crest for 90°, at zero amplitude again at 180°, at a trough for 270°, and back to zero amplitude at 360°, which is also 0° for the start of the next period. Any point in the wave can be represented by an angle between 0° and 360°. A line drawn with its length representing the magnitude of the amplitude and its angle representing the position in the periodic motion, is a vector representing the wave motion. The angle of the vector is its phase angle. The angle between two vectors, one for each of two different wave motions, is the phase angle between the two wave motions. ↑ PENCIL → SIMPLE HARMONIC MOTION

NB017 phase difference (*n.*) The difference in phase between two wave forms. Phase difference is measured by the phase angle between the waves When two waves have a phase difference of 90° (or $\frac{\pi}{2}$ radians) one wave is at maximum amplitude when the other wave is at zero amplitude. With a phase difference of 180° (π radians), both waves have zero amplitude at the same time, but one wave is at a crest when the other wave is at a trough. ↑ PENCIL

NB018 wavelength (*n.*) In a regular wave, the distance between one oscillating particle and the nearest oscillating particle with the same displacement and moving in the same direction (such particles are in phase). In a transverse wave motion, it is the distance between the crest of one wave and the crest of an adjacent wave. In a longitudinal wave motion it is the distance between one point of maximum compression and an adjacent point of maximum compression. Wavelength is defined as the distance between any two successive points of a wave which are in the same phase. The symbol for wavelength is λ (the Greek letter lambda). ↓ WAVE NUMBER · FREQUENCY[1] · WAVE VELOCITY · PHASE VELOCITY · GROUP VELOCITY ↑ WAVE

NB019 wave number (*n.*) The number of waves in unit length, *i.e.* $\frac{1}{\text{wavelength}}$ The symbol for wave number is σ (the Greek letter sigma), and the quantity is a pure number:

$$\sigma = \frac{1}{\lambda}.$$

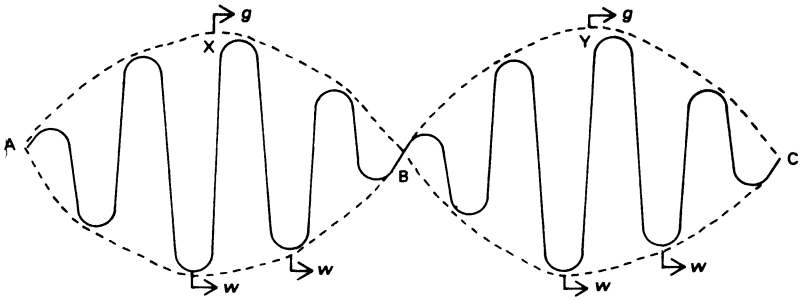
↑ WAVELENGTH

NB020 frequency[1] (*n.*) The number of complete oscillations performed in one second. In a transverse wave this is the same as the number of wave crests assumed to pass a reference point in one second. In a longitudinal wave it is the same as the number of points of maximum compression assumed to pass a reference point in one second. The symbol for frequency is f or ν (the Greek letter nu), and frequency is measured in hertz (Hz). ↑ WAVELENGTH

NB021 wave velocity (*n.*) The velocity with which a crest of a wave moves forward. If the wave velocity in a medium is v, the wavelength is λ, and the frequency f, then $v = f\lambda$. For electromagnetic waves, the symbol for velocity is c, the symbol for frequency is ν (Greek letter nu), and the symbol for wavelength is λ: $c = \nu\lambda$. The velocity of electromagnetic waves in a vacuum is c_0. ↑ WAVELENGTH

NB022 phase velocity (*n.*) Alternative term for WAVE VELOCITY.

NB023 group velocity (*n.*) Suppose two electromagnetic waves of equal amplitude, but slightly differing frequency and wavelength, extend to infinity along a given direction. The amplitude of the disturbances caused by the transmission of energy is modulated by the compounding of the amplitudes of the two waves. This results in a wave system (see illustration over). A segment, AB or BC, is regarded as a wave group; in actual conditions, such a wave group would contain a large number of oscillations of the primary wave, and not a few as illustrated. In a dispersive medium, the two electromagnetic waves have diffe-



THE CONCEPT OF GROUP VELOCITY

rent velocities (because they have different wavelengths); the compounding of the two waves produces a wave system in which the crest (marked X) moves with a velocity g. The primary electromagnetic wave (one of the two) moves with a velocity w, and the two velocities differ in a dispersive medium. A train of waves only possesses a group velocity when travelling in a dispersive medium. In such a medium, the relation between g and w is:

$$g = w - \lambda \frac{dw}{d\lambda}$$

The group velocity depends on the mean wavelength of a train of waves and on the rate of change of velocity with wavelength. In a vacuum:

$$\frac{dw}{d\lambda} = 0$$

(all wavelengths have the same velocity), and $g = w$. In this case group and wave velocity are the same. A train of waves is propagated at the group velocity in any medium; this is the measured velocity of a wave motion. ↑ WAVELENGTH

NB024 medium[1] (*n.,pl.* **media**) A wave motion implies a variation in some form of a property (spatial, electric, magnetic); this in turn implies there is something which has these properties; it is called the medium of the wave motion. A wave motion must have a medium; it can be a material medium or a non-material medium, *i.e.* free space. Different media have different properties and these alter the velocity and the wavelength of a wave motion; the frequency of the wave motion, however, is always the same as the frequency of the source. Media are said to be dense when the velocity of a wave motion is reduced □ *a medium transmits a wave motion* ↓ WAVE FRONT · HUYGEN'S CONSTRUCTION · SPECULAR REFLECTION ↑ WAVE → TRANSMIT · PROPAGATE

NB025 wave front (*n.*) The surface formed by joining adjacent points which possess the same phase in the path of a wave motion. Generally it is regarded as the advancing limit of a wave motion in two or three dimensions in a medium. ↑ MEDIUM[1]

NB026 Huygen's construction (*n.*) A method of treating wave motion by assuming that every point on a wave front is sending out a new train of waves; such points are sources of secondary waves. The construction enables the position of the wave front to be determined at any subsequent time. ↑ MEDIUM[1]

NB027 specular reflection (*n.*) Regular or perfect reflection from a surface. In reflecting electromagnetic waves the surface must be sufficiently flat for any irregularities not to exceed one eighth of the incident wavelength. ↑ MEDIUM[1]

NB028 sinusoidal (*adj.*) Describes a quantity which changes in magnitude with time according to a sine curve. ↓ COHERENT ↑ WAVE · WAVE FORM

NB029 coherent (*adj.*) **1** Describes electromagnetic waves that have identical phases. **2** Describes sources of electromagnetic radiation that produce coherent waves. Coherent sources are usually formed by doubling a single source, using two slits or a biprism. ↑ SINUSOIDAL

NB030 interference[2] (*n.*) The interaction of two wave trains when they are superposed. The wave trains must be coherent and of the same frequency, and must be of the same, or of comparable, amplitude. In such wave-trains, if the crest of one wave is superposed on the trough of another, the wave is destroyed at that point; if a crest is superposed on a crest, the waves reinforce each other. The amplitudes of the waves at any point, when superposed, are added algebraically. The superposition of two wave trains of light produce alternate bands of brightness and darkness; this is interference. Similarly, other wave motions produce alternate bands of no energy and higher energy than the individual waves. Examples of interference are, ***a*** beats formed by sound waves; ***b*** the phenomenon of diffraction; ***c*** the colour effects seen in thin films. Interference is a phenomenon which distinguishes the transmission of energy by a wave motion from transmission by a beam of particles. ↓ PATH DIFFERENCE · STATIONARY WAVE · BIPRISM · DIFFRACTION[1] ·

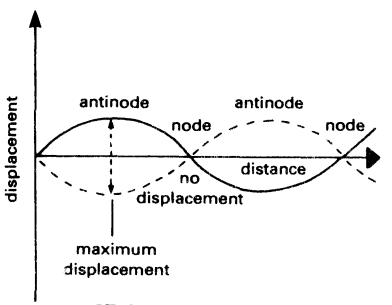
DIFFRACTION GRATING · SUPERPOSE · MONOCHROMATIC ↑ WAVE

NB031 path difference (*n.*) The difference in distance travelled by two wave trains emitted from the same source, but following different paths to the same point. If the path difference is an odd number of half-wavelengths, the wave is destroyed; if it is an even number of half-wavelengths, *i.e.* a whole number of wavelengths, the waves reinforce each other. ↓ HUYGEN'S PRINCIPLE OF SUPERPOSITION · INTERFERENCE BANDS · FRINGE[2] ↑ INTERFERENCE[2]

NB032 Huygens' principle of superposition (*n.*) The principle that the resultant displacement at any point in a medium arising from the superposition of any system of waves is equal to the sum of the displacements arising from each individual wave at that point. This is the basis of interference of wave systems. ↑ PATH DIFFERENCE

NB033 interference bands (*n.pl.*) Bands of alternate high amplitude and low amplitude formed by the superposition of two coherent wave trains. With a monochromatic source of light, the bands are alternately bright and dark; with white light, the interference bands are coloured. A similar effect, invisible but detectable, is formed by other monochromatic wave motions. ↑ PATH DIFFERENCE

NB034 fringe[2] (*n.*) A sharp, well-defined interference band produced with light. ↑ PATH DIFFERENCE



STATIONARY WAVE

NB035 stationary wave (*n.*) A wave form produced by the interference of two wave motions of identical amplitude and identical frequency moving simultaneously through a medium in opposite directions, with identical velocities. A pattern is formed of alternating points of zero displacement (nodes) and maximum displacement (antinodes) with intermediate displacements between these two points to form a smooth curve. This pattern is best seen in a vibrating string which develops a series of loops (between nodes). Both transverse and longitudinal wave motions can form stationary waves. ↓ NODE[3] · ANTINODE[1] · STANDING WAVE ↑ INTERFERENCE[2] → TRANSVERSE WAVE · WAVE MOTION

NB036 node[3] (*n.*) A point of zero displacement or zero variation in a stationary wave; a node remains at zero displacement or zero variation throughout the period of transmission of the wave motion. The distance between any two adjacent nodes is half a wavelength of the stationary wave. ↑ STATIONARY WAVE

NB037 antinode[1] (*n.*) A point of maximum displacement or maximum variation in a stationary wave; a particle at an antinode alternates between maximum displacements on either side of its zero displacement. An antinode occurs midway between two adjacent nodes at a distance of a quarter of a wavelength from either node. ↑ STATIONARY WAVE

NB038 standing wave (*n.*) Alternative term for STATIONARY WAVE (↑).

NB039 biprism (*n.*) A prism with a refracting angle of almost 180°; it consists of two acute-angled triangles placed base to base. The biprism produces two virtual images of a slit, and these produce interference fringes at infinity. The fringes can be viewed in the focal plane of a microscope placed in front of the biprism. ↓ NEWTON'S RINGS · THIN FILM · INTERFEROMETER ↑ INTERFERENCE[2]

NB040 Newton's rings (*n.pl.*) Alternate bright and dark rings formed when a convex lens, with large radius of curvature, rests on a flat glass plate. The rings are caused by interference between light waves reflected from the upper surface of the air film between the lens and the plate and light waves reflected from the lower surface of the air film. With white light, concentric coloured rings are formed. With monochromatic light the rings are alternately dark and bright. ↑ BIPRISM

NB041 thin film (*n.*) A layer of liquid on the surface of a solid or of another liquid, usually only a few molecules thick. Interference between light reflected from the upper and lower surfaces of the film causes the formation of fringes. A thin film of oil on water, or on a road surface, exhibits the pattern of colours. This interference effect is similar to that of Newton's rings. ↑ BIPRISM

NB042 interferometer (*n.*) An instrument which splits a beam of light into a number of coherent beams and then superposes the beams to obtain interference fringes. Observations on the fringes are used in accurate determinations of wavelengths of light. The instrument is also used for examination of the hyperfine structure of spectra, the testing of prisms and lenses for refraction purposes, and the accurate measurement of distance. ↑ BIPRISM

NB043 diffraction[1] (*n.*) A phenomenon associated with a wave motion when a wave train passes the edge of an obstacle opaque to the wave motion; the phenomenon is a particular case of interference. The waves are bent at the edge of the obstacle, which acts as a source of secondary waves, all coherent. Interference between a primary wave and a secondary wave produces diffraction bands, which are, in fact, interference bands. Although a wave

motion travels by rectilinear propagation, the edge of the geometric shadow of an obstacle is marked by interference bands. With white light, coloured diffraction bands are formed; with monochromatic light, bright and dark bands are formed. If the wave motion is passed through a slit, the intensity of the bands is increased when the width of the slit is of the same order of magnitude as the wavelength of the wave motion. ↓ FRAUNHOFER DIFFRACTION · FRESNEL DIFFRACTION ↑ INTERFERENCE[2]

NB044 Fraunhofer diffraction (*n.*) A type of diffraction in which the light source and the receiving screen are effectively at an infinite distance from the diffraction device, *i.e.* parallel beams of wave trains are used. ↑ DIFFRACTION[1]

NB045 Fresnel diffraction (*n.*) A type of diffraction in which the light source and the receiving screen are both at a finite distance from the diffraction device, *i.e.* divergent and convergent beams of wave-trains are used. ↑ DIFFRACTION[1]

NB046 diffraction grating (*n.*) A device for dispersing a wave train into its constituent wavelengths. It consists of a series of parallel obstacles (opaque to the wave) or a series of parallel slits, each of width of the same order as the wavelength in the wave train. Each slit causes diffraction and the bending of the wave is proportional to the wavelength of the impinging wave train. If the wave train is polychromatic, it is split into a spectrum of wavelengths, with each slit bending the same wavelength at an identical angle, so the emergent rays are parallel, producing an image of the wavelength at infinity. Because of the great variation possible in the wavelengths of electromagnetic wave motions, devices for diffraction vary considerably in their structure. A diffraction grating usually describes the device used for light waves, and for wavelengths on either side of the visible spectrum. It consists of lines ruled on an optical glass surface. Gratings for X-rays use crystal structures; those for electrons use metal crystals; those for radar waves use hardboard strips a few centimetres apart. ↓ TRANSMISSION GRATING · REFLECTING GRATING · BRAGG'S LAW ↑ INTERFERENCE[2]

NB047 transmission grating (*n.*) A type of diffraction grating in which the radiation is transmitted through the grating. For light, a plane optical glass surface is ruled with fine lines (about 6000 per cm) and light is passed through the grating. The position of the spectral bands is given by:

$$n\lambda = (a + b) \sin \theta$$

where $n = 0, 1, 2, 3 \ldots$, λ is the wavelength, b is the width of a slit, a is the distance between adjacent slits, and θ is the deviation (angle of diffraction). For each value of n a diffraction band will be formed. ↑ DIFFRACTION GRATING

NB048 reflecting grating (*n.*) A type of diffraction grating in which the radiation is reflected from the surface of the grating. For light, a plane metal surface is ruled with fine lines (similar to a transmission grating). For X-rays, a crystal with a suitable structure is used. Gratings can be curved as well as plane, in which case they are self-focusing. ↑ DIFFRACTION GRATING

NB049 Bragg's law (*n.*) Successive parallel layers of atoms or ions in a crystal act as a diffraction grating to produce a diffraction spectrum. If s is the distance between parallel layers of atoms, or ions, λ is the wavelength of the incident beam, θ is the glancing angle, and n is 0, 1, 2, 3 . . . , then:

$$n\lambda = 2s \sin \theta$$

Diffraction bands are formed for each value of n. Bragg's law is applied to the diffraction of X-rays by suitable crystals. ↑ DIFFRACTION GRATING

NB050 superpose (*v.t.*) To put an object exactly over the top of another. The term is also used to describe the action of two trains of waves simultaneously passing over the same point, when the waves are said to be superposed at that point. —***superposition*** (*n.*) ↓ IMPINGE · GLANCE ↑ INTERFERENCE[2]

NB051 impinge (*v.i.*) To make an impact with some force □ *to impinge on a surface* ↑ SUPERPOSE

NB052 glance (*v.i.*) To collide with the surface of an object at a very small angle. The direction of meeting is almost parallel to the surface of the object. ↑ SUPERPOSE

NB053 monochromatic (*adj.*) **1** Describes light, or any other electromagnetic radiation, of one wavelength only, *e.g.* light from a sodium flame emits light of a wavelength of 589 nm. **2** Describes a source that emits monochromatic radiation. ↓ POLYCHROMATIC ↑ INTERFERENCE[2]

NB054 polychromatic (*adj.*) **1** Describes light, or other electromagnetic radiation, composed of many different wavelengths. **2** Describes a source of polychromatic radiation. ↑ MONOCHROMATIC

NB055 polarization[2] (*n.*) The process of limiting the modes of vibration of the electric and magnetic disturbances in electromagnetic waves. The electric and magnetic vibrations in any wave motion take place in all possible planes concurrent in the path of a normal wave. Each electric vibration is at right angles to the path of the wave, and associated with it is a magnetic vibration at right angles to both the electric vibration and the path of the wave. These vibrations can be altered in plane, circularly and elliptically polarized electromagnetic waves. —POLARIZE (*v.*) POLARIZED (*adj.*) ↓ PLANE POLARIZATION · DOUBLE REFRACTION · QUARTER-WAVE PLATE · OPTICAL ACTIVITY · POLARIMETER · BIREFRINGENT → WAVE

NB056 plane polarization (*n.*) A process in which the electric vibrations are confined to one plane, called the plane of vibration. The magnetic vibrations are confined to a second plane, perpendicular to the vibration plane; the second plane is called the plane of polarization. The path of the electromagnetic wave is at the intersection of

these two planes. This convention is usually adopted for light waves in the visible spectrum. ↓ ANGLE OF POLARIZATION · BREWSTER'S LAW · POLARIZING ANGLE · PHOTOELASTICITY ↑ POLARIZATION[2]

NB057 angle of polarization (*n.*) Light reflected from a plane surface is subject to plane polarization; the angle of incidence at which the greatest degree of plane polarization is obtained is called the angle of polarization. ↑ PLANE POLARIZATION

NB058 Brewster's law (*n.*) The principle that the tangent of the angle of polarization for a reflecting medium is equal to its refractive index. ↑ PLANE POLARIZATION

NB059 polarizing angle (*n.*) Alternative term for ANGLE OF POLARIZATION (↑).

NB060 photoelasticity (*n.*) A property of transparent substances under stress, in which the lines of strain produce colour when plane polarized light is passed through the substance. Photoelasticity is used to examine engineering problems on stresses by making small transparent scale models. ↑ PLANE POLARIZATION

NB061 double refraction (*n.*) The phenomenon exhibited by certain crystals, such as calcite, quartz, and tourmaline, in which an incident ray of light is split into two rays, called an **ordinary ray** and an **extraordinary ray.** ↓ ORDINARY RAY · EXTRAORDINARY RAY · OPTIC AXIS · PRINCIPAL SECTION · POSITIVE CRYSTAL · NEGATIVE CRYSTAL · BIREFRINGENCE ↑ POLARIZATION[2] → REFRACTION

NB062 ordinary ray (*n.*) (In a birefringent crystal) the ray that obeys the ordinary laws of refraction. It is plane polarized by the crystal in a plane parallel to the optic axis of the crystal. ↑ DOUBLE REFRACTION

NB063 extraordinary ray (*n.*) (In a birefringent crystal) the ray that does not obey the ordinary laws of refraction. It is plane polarized by the crystal in a plane at right angles to the optic axis of the crystal, and the ratio $(\sin i)/(\sin r)$ varies with the angle of incidence; the least value of the ratio is called the extraordinary refractive index (symbol n_e). ↑ DOUBLE REFRACTION → REFRACTIVE INDEX

NB064 optic axis (*n.*) (In a birefringent crystal) the direction in which light is transmitted without double refraction. ↑ DOUBLE REFRACTION

NB065 principal section (*n.*) (In a birefringent crystal) a plane which is parallel to the optic axis and perpendicular to two opposite faces. ↑ DOUBLE REFRACTION

NB066 positive crystal (*n.*) A birefringent crystal in which the ordinary ray travels faster than the extraordinary ray. The extraordinary refractive index is always greater than the ordinary refractive index. Quartz is an example of a positive crystal. ↑ DOUBLE REFRACTION → REFRACTIVE INDEX

NB067 negative crystal (*n.*) A birefringent crystal in which the ordinary ray travels more slowly than the extraordinary ray. The extraordinary retractive index is always less than the ordinary refractive index. Calcite is an example of a negative crystal. ↑ DOUBLE REFRACTION

NB068 birefringence (*n.*) Alternative term for DOUBLE REFRACTION. —BIREFRINGENT (*adj.*)

NB069 quarter-wave plate (*n.*) A thin plate of a birefringent substance, such as calcite or quartz, is cut parallel to the optic axis of the crystal, and of a specific thickness, calculated to give a phase difference of 90° ($\frac{\pi}{2}$) between the emergent ordinary ray and the emergent extraordinary ray for light of a specified wavelength. Quarter-wave plates are usually constructed for wavelengths of sodium light (589 nm). If the angle between the plane of polarization of light incident upon the plate and the optic axis of the plate is 45°, then circularly polarized light is produced and emerges from the plate; if the angle is other than 45°, elliptically polarized light is produced. ↓ HALF-WAVE PLATE · CIRCULAR POLARIZATION · ELLIPTICAL POLARIZATION ↑ POLARIZATION[2]

NB070 half-wave plate (*n.*) A thin plate, of similar construction to a quarter-wave plate, but of such a thickness that the emergent ordinary and extraordinary rays differ in phase by 180° (π). Half-wave plates are usually constructed for use with the wavelength of sodium light. A half-wave plate produces plane polarized light; its chief use is to alter the plane of polarization of plane polarized light. ↑ QUARTER-WAVE PLATE

NB071 circular polarization (*n.*) When plane polarized light is passed through a quarter-wave plate the light is split into two components; they are of equal amplitude if the incident light's plane of polarization is at 45° to the optic axis of the plate. Each component is perpendicular to the other, and the emergent rays differ in phase by 90° ($\frac{\pi}{2}$). The emergent rays combine to form a ray which is said to be circularly polarized. The description arises from the behaviour of the electric vibration of the electromagnetic wave, which executes two simple harmonic motions at right angles to each other and with a phase difference of 90°, the resultant motion of the electric vibration being a circle perpendicular to the direction of the wave, with the wave as the axis of the circle. Other electromagnet waves can undergo circular polarization. ↑ QUARTER-WAVE PLATE

NB072 elliptical polarization (*n.*) Plane polarized light is split into two components of unequal amplitude, each polarized perpendicularly to the other, and differing in phase by any angle other than 90°, 180°, 270°, or 360°. The electric vibrations of the emergent ray, formed by the superposition of the two components, have a resultant which is an ellipse, the form of which depends on the amplitudes and the phase difference of the two components' electric

vibrations. It is said to be elliptically polarized. Other electromagnetic waves can also undergo elliptical polarization, *e.g.* radio waves in some systems of colour television emission. ↑ QUARTER-WAVE PLATE

NB073 optical activity (*n.*) The property of some substances, or their solutions, of rotating the plane of polarization of light; such substances possess molecules which are asymmetric in structure. Quartz is an example of a solid substance; sugars and tartaric acid in solution are examples of solutions. For solutions, the degree of rotation depends on the concentration of the solution and the distance light travels through the solution. The degree of rotation also depends on the wavelength of the incident polarized light. ↓ ROTARY DISPERSION · OPTICAL ROTARY POWER · OPTICAL ROTATION · SPECIFIC ROTATION · MOLECULAR ROTATION ↑ POLARIZATION[2]

NB074 rotary dispersion (*n.*) The dispersion of light arising from the difference in the rotatory power of a medium for different wavelengths. ↑ OPTICAL ACTIVITY

NB075 optical rotary power (*n.*) The quantitative measure of optical activity. It is the optical rotation produced by a column of solution of known length. The optical rotary power depends upon the concentration and temperature of the optically active solution and on the wavelength of the plane polarized light. Optical rotary power is measured either as the specific rotation, or as the molecular rotation. ↑ OPTICAL ACTIVITY

NB076 optical rotation (*n.*) The angle through which plane polarized light is rotated by an optically active liquid. ↑ OPTICAL ACTIVITY

NB077 specific rotation (*n.*) Specific rotation (α) is defined as:

$$\alpha = \frac{\text{rotation per decimetre of solution}}{\text{concentration of the solution}}$$

↑ OPTICAL ACTIVITY

NB078 molecular rotation (*n.*) Molecular rotation is measured by the specific rotation multiplied by the molar mass of the solute, or for a pure liquid, by the molar mass of the liquid. ↑ OPTICAL ACTIVITY

NB079 polarimeter (*n.*) An instrument for measuring the rotation of the plane of polarization by liquids or by solutions. Light is polarized by a Nicol prism (the **polarizer**), passed through a tube containing the liquid, or solution, and viewed through a second Nicol prism (the **analyser**). The analyser is rotated until light is extinguished, showing the Nicol prisms are crossed; the angle through which the analyzer is turned to get this effect is the degree of rotation of the solution. A common use of a polarimeter is the measurement of concentration of various sugar solutions. ↓ NICOL PRISM · POLARIZER · ANALYSER · SPECIFIC ROTARY POWER ↑ POLARIZATION[2]

NB080 Nicol prism (*n.*) A prism formed from two pieces of calcite cemented together with Canada balsam; the prism is made in such a way that the ordinary ray suffers total internal reflection, and only the extraordinary ray passes through the prism; this ray is plane polarized. A Nicol prism is a common device for obtaining plane polarized light □ *when Nicol prisms are crossed, their planes of polarization are perpendicular, and no light passes through both prisms* ↑ POLARIMETER

NB081 polarizer (*n.*) See POLARIMETER (↑).

NB082 analyser (*n.*) See POLARIMETER (↑).

NB083 specific rotary power (*n.*) A measure of the optical activity of a solute; it is the angle through which the plane of polarization would be rotated by a column of solution 0·1 m long, containing 1 g of solute in 1 cm^3. ↑ POLARIMETER

NB084 birefringent (*adj.*) Describes a substance exhibiting double refraction. ↓ UNIAXIAL · LAEVOROTATORY · DEXTROROTATORY ↑ POLARIZATION[2]

NB085 uniaxial (*adj.*) Describes a birefringent crystal with only one optic axis; calcite and quartz are common examples. ↑ BIREFRINGENT

NB086 laevorotatory (*adj.*) Describes a substance, either solid, liquid, or solution, which rotates the plane of polarization of light to the left. When viewed in the direction of the source, the plane of polarization is rotated in an anticlockwise direction. ↓ DEXTROROTATORY (Cn) ↑ BIREFRINGENT

NB087 dextrorotatory (*adj.*) Rotating the plane of polarization of light to the right. When viewed in the direction of the source, the plane of polarization is rotated in a clockwise direction. ↑ BIREFRINGENT

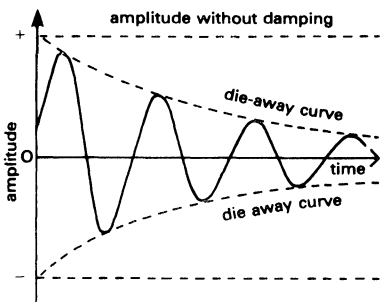
NB088 oscillation (*n.*) **1** The act of oscillating, or the condition of oscillating. **2** One complete motion between the limits of an oscillating object, *e.g.* the motion of a pendulum bob from one side to another is one oscillation □ *the object is in oscillation about a point* —OSCILLATE (*v.*) OSCILLATING, OSCILLATORY (*adj.*) ↓ VIBRATION · FORCED VIBRATION[1] · SIMPLE HARMONIC MOTION · COMPOUND[2] · OSCILLATING · DAMPED → WAVE · OSCILLATE

NB089 vibration (*n.*) A periodic movement of an elastic material; the shape of the material is distorted by a force, the elasticity restores the shape, moves the material past its rest position until the elasticity again restores the shape, and the sequence of events continues. Each piece of an elastic material has, associated with the method of suspension, a natural frequency of vibration, *e.g* a metal rod rigidly suspended at one end has a characteristic frequency. An impulse sets the body vibrating with its natural frequency. ↓ VIBRATOR · DAMPING[1] · DIE-AWAY CURVE ↑ OSCILLATION → VIBRATE

NB090 vibrator (*n.*) Any device which produces periodic impulses of energy, *e.g.* ***a*** the device producing waves in a ripple tank; ***b*** a make-and-break device producing a periodic intermittent current in an

induction coil. ↑ VIBRATION

NB091 damping[1] (*n.*) **1** A decrease in the amplitude of an oscillation, vibration, or a wave motion, so that the amplitude becomes progressively less with time. **2** Any action which causes the amplitude of an oscillation or vibration to decrease with time. In any oscillating or vibrating system, damping arises from energy losses occurring in the system, *e.g.* ***a*** a pendulum swinging freely is damped by the resistance of the air to the motion of the bob; ***b*** in an oscillating electrical circuit, damping arises from the energy lost in heating the components. —***damp*** (*v.*) DAMPED (*adj.*) ↑ VIBRATION



DIE-AWAY CURVE

NB092 die-away curve (*n.*) A curve joining the peaks of a damped oscillation or wave motion. In the case of a damped oscillation, the amplitude decreases exponentially with time in most cases. ↑ VIBRATION

NB093 forced vibration[1] (*n.*) The condition when a body is set vibrating with a frequency other than its natural frequency. Such vibrations are quickly damped by the inherent forces within the system and the amplitude of the forced vibration is small, *e.g.* the support of a loaded helical spring is given a periodic motion in a vertical direction; if the frequency of the support differs from the natural frequency of the spring, the spring vibrates with a small amplitude and the same frequency as the initiating periodic motion. ↓ FORCED OSCILLATION · RESONANCE[1] ↑ OSCILLATION

NB094 forced oscillation (*n.*) A condition corresponding to a forced vibration. A small periodic force is applied to a system capable of oscillation; the frequency of the force differs from the natural frequency of the system, thus the system oscillates with a small amplitude. ↑ FORCED VIBRATION[1]

NB095 resonance[1] (*n.*) An effect caused by the application of a periodic force to a system capable of oscillation, or to a body capable of vibration, when the frequency of the force is identical with the natural frequency of the system or of the body. The amplitude of oscillation of the system or of vibration of the body becomes very large, and the system or body is said to exhibit resonance, or to resonate, *e.g.* ***a*** if a pendulum is given a series of impulses such that the frequency of imparting the impulses is identical to the frequency of the pendulum, then the amplitude of the pendulum becomes very great; the pendulum is in resonance with the series of impulses; ***b*** if a tuning fork of a given frequency is held over a glass tube containing a column of air of the same frequency as the tuning fork, the column of air resonates to the tuning fork and emits a loud note indicating a great amplitude of oscillation of the air molecules; ***c*** if an oscillatory electric current is supplied to an electric circuit of the same frequency as the electric current, the electric circuit resonates □ *a body is in resonance with an applied periodic force; a body exhibits resonance when it is resonating* —RESONATE (*v.*) RESONATING, ***resonant*** (*adj.*) ↑ FORCED VIBRATION[1]

NB096 simple harmonic motion (*n.*) A particle or body moves in simple harmonic motion when it oscillates about a fixed point in a linear motion, and

$$\frac{\text{acceleration towards its position of rest}}{\text{distance from its position of rest}} = \text{a positive constant.}$$

If the positive constant is denoted by ω^2 (the Greek letter omega) then the period of the simple harmonic motion is given by:

$$T = \frac{2\pi}{\omega}$$

Examples of simple harmonic motion are, ***a*** a body suspended on a helical spring, oscillating up and down; ***b*** a simple pendulum swinging from side to side (at small amplitudes only) □ *a body executes simple harmonic motion* ↓ POSITION OF REST · S.H.M. · AMPLITUDE[2] ↑ OSCILLATION

NB097 position of rest (*n.*) The position of the body, or particle, from which it can be released without acquiring any motion, *e.g.* the bottom of the swing of a pendulum. It is the position about which a particle executes simple harmonic motion.

NB098 S.H.M. (*n.*) Abbreviation for SIMPLE HARMONIC MOTION. Two S.H.M.s are in phase if they pass through the position of rest at the same time, and are moving in the same direction. ↑ SIMPLE HARMONIC MOTION

NB099 amplitude[2] (*n.*) (In an oscillating motion) the maximum displacement from equilibrium, *e.g.* in a pendulum, the amplitude is the maximum distance the pendulum swings from the position of rest. ↑ SIMPLE HARMONIC MOTION

NB100 compound[2] (*v.t.*) To combine simple harmonic motions. One simple harmonic motion can be compounded with another simple harmonic motion, or with more. The S.H.M.s can be, ***a*** in or out of phase; ***b*** of identical or different amplitudes; ***c*** of identical or different periods. Simple cases: **1** identical amplitudes, out of phase by $\frac{\pi}{2}$, identical periods the particle

moves in a circle; the radius of the circle is the same as the amplitude of either S.H.M.; the time for the particle to travel once round the circle is the same as the period of the S.H.M.s; **2** different amplitudes, out of phase by $\frac{\pi}{2}$, identical periods—the particle moves in an ellipse; the two axes of which are the same as the amplitude of the S.H.M.s; the time for the particle to travel once round the ellipse is the same as the period of the two S.H.M.s. ↓ DIE AWAY ↑ OSCILLATION

NB101 die away (*v.i.*) (Of oscillations) to decrease in amplitude with time, and hence for energy propagated by a wave motion, to decrease in intensity, *e.g.* ***a*** the sound of the tuning fork died away; ***b*** the intensity of X-rays dies away more quickly in lead than in aluminium. ↑ COMPOUND[2] → DIE-AWAY CURVE

NB102 oscillating (*adj.*) Describes that which is undergoing oscillation, *e.g.* an oscillating pendulum. ↓ OSCILLATORY · VIBRATING · VIBRATORY · VIBRATIONAL · VIBRATILE ↑ OSCILLATION

NB103 oscillatory (*adj.*) Describes that which causes oscillation, *e.g.* an oscillatory electrical circuit produces oscillations in electric current. ↑ OSCILLATING

NB104 vibrating (*adj.*) Describes a body undergoing vibration. ↑ OSCILLATING

NB105 vibratory (*adj.*) Describes that which causes vibration, or has the disposition to vibrate, *e.g.* ***a*** a vibratory force applied to a body; ***b*** a stretched string is vibratory as it has the ability to vibrate. ↑ OSCILLATING

NB106 vibrational (*adj.*) Of or to do with the process of vibrating. Vibrational energy is the energy associated with vibration. ↑ OSCILLATING

NB107 vibratile (*adj.*) Describes a structure which vibrates by its own power, *e.g.* a vibratile membrane in certain flagellates (the motion of the membrane moves the organism through water). ↑ OSCILLATING

NB108 damped (*adj.*) Describes oscillations or vibrations which gradually decrease in amplitude, as a result of loss of energy. ↓ UNDAMPED (An) · RESONATING · RESONANT · DEAD-BEAT · ASTATIC ↑ OSCILLATION

NB109 undamped (*adj.*) Describes oscillations or vibrations which continue with the original amplitude unchanged. As most oscillating systems suffer a natural loss of energy arising from physical conditions, an undamped oscillation is rare. If the oscillating system is supplied with energy to overcome these losses, the system can behave as if undamped, *e.g.* the pendulum of a clock suffers energy losses from air friction, but the clock mechanism supplies energy with each swing, and it is sufficient to keep the pendulum swinging as if undamped. ↑ DAMPED (An)

NB110 resonating (*adj.*) Describes an oscillatory system, or a body capable of vibration, which is in resonance. ↑ DAMPED

NB111 resonant (*adj.*) Of or to do with the disposition to resonate, *e.g.* ***a*** a resonant circuit is one which will exhibit resonance when the applied force has the correct frequency; ***b*** a resonant circuit is one with the same frequency as the oscillatory electric current supplied. The focus is on the ability to resonate. Contrast **resonating**; a resonating circuit is one in resonance—the focus is on the condition of the circuit. ↑ DAMPED

NB112 dead-beat (*adj.*) Describes an instrument which gives a reading without the pointer oscillating about the reading before it comes to rest. ↓ ASTATIC (An) ↑ DAMPED

NB113 astatic (*adj.*) Describes an instrument or device which does not tend to show a fixed reading or to take up a fixed position. The pointer of an astatic meter oscillates about the true reading and takes a long time to come to rest, *e.g.* the pointer of an astatic galvanometer oscillates about a reading and only slowly comes to rest. ↑ DAMPED · DEAD-BEAT (An)

NB114 pendulum (*n.*,*pl.* **pendula**) A body pivoted above its centre of gravity so that it can swing freely in a vertical plane. The simplest type is a bob at the end of a string. When given an impulse, a pendulum swings from side to side with a periodic motion. An ideal pendulum consists of a weightless, inextendible string with the mass concentrated at one point in the bob and the angle of amplitude of swing less than 5°. For an ideal pendulum, the period, T, is given by the formula:

$$T = 2\pi \sqrt{\frac{l}{g}}$$

where l is the length of the string and g is the acceleration due to gravity. ↓ SIMPLE PENDULUM · COMPOUND PENDULUM · PERIODIC[2] → WAVE

NB115 simple pendulum (*n.*) A pendulum with a bob and a string as near to an ideal pendulum as possible. ↓ BOB · PERIOD[3] ↑ PENDULUM

NB116 bob (*n.*) A heavy mass of metal used in a pendulum. ↑ SIMPLE PENDULUM

NB117 period[3] (*n.*) If an event occurs regularly in time, then the time taken between successive events is called the period. In the motion of a pendulum, the period is the time taken between the pendulum bob successively passing through the same point in the same direction. If a particle moves in a circular or an elliptical path, the period of the motion is the time between the particle passing successively through any given point. The period of the Earth's revolution is one year, *i.e.* the time between the Earth passing successively through a given point. The period of an oscillating system is the

reciprocal of its frequency. If T is the period and f the frequency, then:

$$T = \frac{1}{f}$$

↑ SIMPLE PENDULUM

NB118 compound pendulum Any rigid body pivoted to swing in a vertical plane. ↓ MOMENT OF INERTIA[2] · CENTRE OF SUSPENSION · RADIUS OF GYRATION ↑ PENDULUM

NB119 moment of inertia[2] (*n.*) A measure of the resistance of a rotating body to a change in the rate of motion. It is calculated from:

$$I = \Sigma r^2 dm$$

where I is the moment of inertia, dm is the mass of a small element of the body, and r is the distance of the element from the axis of the body. ↑ COMPOUND PENDULUM

NB120 centre of suspension (*n.*) The point in a rigid body at which it is suspended to form a compound pendulum. ↑ COMPOUND PENDULUM

NB121 radius of gyration (*n.*) The radius of gyration, k, of a body is calculated from

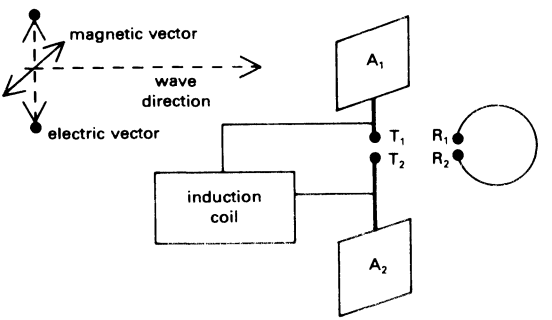
$$I = mk^2$$

where I is the moment of inertia of the body and m is its mass. ↑ COMPOUND PENDULUM

NB122 periodic[2] (*adj.*) Describes a process that consists of a series of identical events taking place at regular intervals of time, the interval being the period of time between the events. The events themselves are also said to be periodic, *e.g.* *a* the swing of a pendulum is periodic; *b* the Earth's motion round the sun is periodic. ↓ APERIODIC (An) ↑ PENDULUM

NB123 aperiodic (*adj.*) Not periodic; not showing any regularity in time interval between successive events. Also describes any instrument pointer or needle which goes straight to the reading and remains stationary without oscillating from side to side about the actual reading. ↑ PERIODIC[2]

Electromagnetic Waves



HERTZ'S APPARATUS

NC001 electromagnetic radiation (*n.*) The first electromagnetic waves were produced by Hertz (in 1888) using the apparatus shown. A_1 and A_2 were two square metal plates, one above the other, forming a kind of capacitor. The induction coil charged the capacitor, and when the insulation between T_1 and T_2 broke down, sparks passed between the knobs, forming a damped oscillatory current. The oscillatory current consisted of accelerating electric charges, which produced a changing electric field, in turn inducing a magnetic field at right angles to the gap between the knobs. A pattern of changing electric and magnetic fields was thus produced by the oscillatory current. Some of the lines of force formed closed loops which travelled into space carrying away some of the kinetic energy of the charges. An electromagnetic wave was produced with the electric vector parallel to T_1T_2; the corresponding magnetic vector was perpendicular to T_1T_2, and both vectors were perpendicular to the wave direction. A coil of wire, of one turn, with a gap between two knobs, R_1 and R_2, was held in a vertical plane in line with T_1T_2; it became linked with the magnetic field and an e.m.f. was induced in it, resulting in a spark discharge between R_1 and R_2. With the coil at right angles to T_1T_2, no spark discharge took place, so the radiation was polarized. Using the apparatus, the radiation was shown to have all the properties of a wave: it could be reflected from a metal sheet, refracted by a non-conductor such as paraffin wax, and exhibited interference and the formation of stationary waves. ↓ ELECTROMAGNETIC WAVES · ELECTROMAGNETIC SPECTRUM · IRRADIATION · IRRADIATED · RADIO WAVES · RADAR · COSMIC RAYS · RADIO-FREQUENCY RADIATION · QUANTUM THEORY → WAVE · ELECTROMAGNETIC

NC002 electromagnetic waves (*n.pl.*) The

generation of an oscillatory magnetic field in a vacuum by an oscillatory electric field depends on the permeability (μ_0) of the vacuum. The generation of an oscillatory electric field in a vacuum depends on the permittivity (ε_0) of the vacuum. To maintain a constant pattern of electric and magnetic fields, which will constitute an electromagnetic wave, moving with a velocity c, a relation exists:

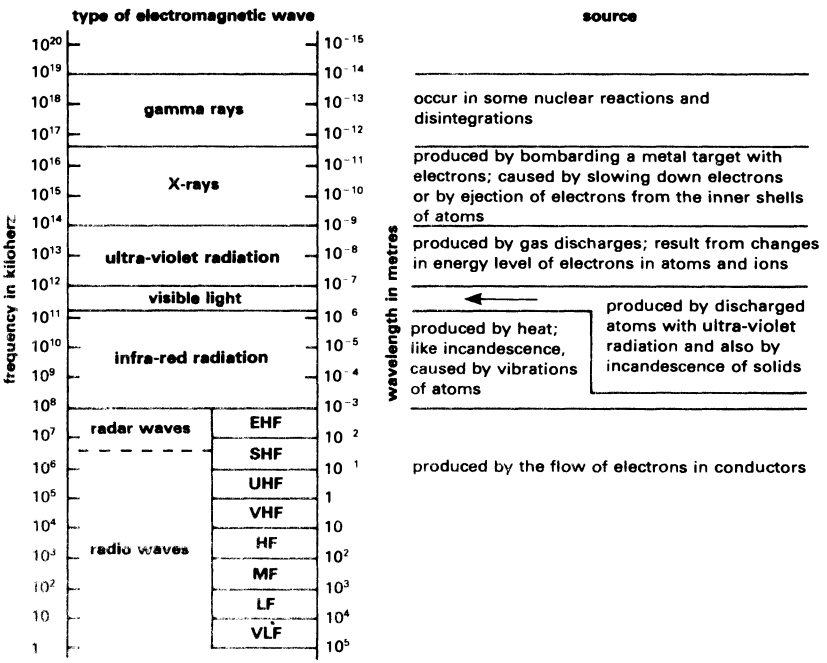
$$c^2\varepsilon_0\mu_0 = 1$$

$$i.e.\ c = \frac{1}{\sqrt{\varepsilon_0\mu_0}}$$

$$= 3 \times 10^{-8}\ \text{m s}^{-1}$$

c is the velocity of all electromagnetic waves in a vacuum or in free space. The frequency of the oscillatory source is the frequency (ν) of the wave generated. Matter, as well as electric charges, emits electromagnetic waves. Properties of the electromagnetic waves are, ***a*** the waves are transverse with electric and magnetic vectors perpendicular to the direction of propagation; ***b*** the waves are polarized in a plane parallel to the electric vector; ***c*** the waves can suffer reflection, refraction, interference, and polarization if the source provides waves with different planes of polarization; ***d*** the velocity is reduced when passing through an electromagnetically denser material (compare light); ***e*** the velocity in a vacuum, or free space, is $3{\cdot}00 \times 10^8 \text{m s}^{-1}$ for all waves, and is the highest speed attainable in the Universe (from the Theory of Relativity); ***f*** the intensity of a wave is reduced exponentially when passing through a dense medium; ***g*** penetration of a medium by a wave depends upon the frequency; as the frequency increases, the penetration increases; ***h*** all waves have rectilinear propagation. ↓ PLANE OF POLARIZATION ↑ ELECTROMAGNETIC RADIATION → RELATIVITY · PERMITTIVITY · PERMEABILITY

NC003 plane of polarization (*n.*) For electromagnetic waves, the plane of polarization can be considered to be the plane of either the electric or the magnetic vector; there is no general agreement on which. The electric vector is more significant when considering the interaction of electromagnetic waves with matter. In radio engineering, television aerials have to be aligned in the plane of the electric vector, and this plane is called the plane of polarization. In the plane polarization of light by reflection, the plane of polarization is taken as the plane containing the incident and reflected ray; this is actually the plane of the magnetic vector, so it should be stated that reflected light is partially plane-polarized with the incident and reflected rays in the plane of the magnetic vector. ↑ ELECTROMAGNETIC WAVES → POLARIZATION[2]


type of electromagnetic wave
source
frequency in kilohertz
wavelength in metres
gamma rays
X-rays
ultra-violet radiation
visible light
infra-red radiation
radar waves
EHF
SHF
UHF
VHF
HF
MF
LF
VLF
radio waves
occur in some nuclear reactions and disintegrations
produced by bombarding a metal target with electrons; caused by slowing down electrons or by ejection of electrons from the inner shells of atoms
produced by gas discharges; result from changes in energy level of electrons in atoms and ions
produced by heat; like incandescence, caused by vibrations of atoms
produced by discharged atoms with ultra-violet radiation and also by incandescence of solids
produced by the flow of electrons in conductors

THE ELECTROMAGNETIC SPECTRUM

NC004 electromagnetic spectrum (*n.*) The range of frequencies (or of wavelengths) of energy radiated by electromagnetic waves. The spectrum is usually considered to extend from gamma rays to radio waves (see diagram for types of waves). The properties of the waves depend upon the frequency. ↓ FILTER[1] ↑ ELECTROMAGNETIC RADIATION → SPECTRUM · GAMMA RAYS · X-RAYS · ULTRA-VIOLET RAYS · INFRA-RED RAYS

NC005 filter[1] (*n.*) A material put in the path of electromagnetic radiation to alter the distribution of frequencies by only allowing certain frequencies to pass, *e.g.* a red filter used with light only allows frequencies in the red region of the spectrum to pass through. ↑ ELECTROMAGNETIC SPECTRUM

NC006 irradiation (*n.*) The process of being exposed to any form of radiation. Intense irradiation may alter the physical and chemical properties of solids; all biological cells are sensitive to irradiation by ionizing radiation. —***irradiate*** (*v.*) IRRADIATED (*adj.*) ↓ IONIZING RADIATION ↑ ELECTROMAGNETIC RADIATION

NC007 ionizing radiation (*n.*) Radiation capable of causing ionization either directly or indirectly. The radiation may be particulate, *i.e.* consist of particles such as alpha particles or beta particles, or it may be electromagnetic, *i.e.* consisting of X-rays or gamma rays. Particulate radiation is usually more effective than electromagnetic radiation in causing ionization. ↑ IRRADIATION

NC008 irradiated (*adj.*) Describes any object exposed to radiation of any kind. ↑ ELECTROMAGNETIC RADIATION

NC009 radio waves (*n.pl.*) Electromagnetic waves generated by an electric current oscillating in a circuit. The frequency of the oscillation depends upon the electrical constants of the circuit; a valve oscillator is the best means of producing radio waves. The spectrum of frequencies is divided arbitrarily into various wavebands. ↓ RADIO FREQUENCY[1] · WAVEBAND · SKIP DISTANCE · MICROWAVE ↑ ELECTROMAGNETIC RADIATION

NC010 radio frequency[1] (*n.*) A frequency in the range of frequencies of the electromagnetic spectrum less than those of infra-red radiation; usually taken to be in the range of 10 kHz to 100 000 MHz. ↓ SKY WAVE · GROUND WAVE · IONOSPHERE WAVE ↑ RADIO WAVES

NC011 sky wave (*n.*) A radio wave has two possible paths from the transmission aerial to the receiving aerial. One wave is called the sky wave and the other is the ground wave. The sky wave is the wave reflected by the ionosphere. ↑ RADIO FREQUENCY[1]

NC012 ground wave (*n.*) A radio wave which travels directly from transmitting aerial to receiving aerial. It may suffer diffraction along its path, so the path is not necessarily straight. A receiving station receives both waves, *i.e.* the ground wave and the sky wave, which may reinforce each other, may cause interference, or may cause fading; alternatively, only one type of wave may be received. ↑ RADIO FREQUENCY[1]

NC013 ionosphere wave (*n.*) Alternative term for SKY WAVE (↑). ↑ RADIO FREQUENCY[1]

NC014 waveband (*n.*) A limited range of wavelengths used in radio; each waveband has general characteristics in its use. ↓ VERY HIGH FREQUENCY · V.H.F · HIGH FREQUENCY · H.F · MEDIUM FREQUENCY · M.F. · LOW FREQUENCY · L.F. · VERY LOW FREQUENCY · V.L.F ↑ RADIO WAVES

NC015 very high frequency (*n.*) A frequency in the range 30 to 300 MHz; *i.e.* corresponding to a wavelength in the range 10 m to 1 m. ↑ WAVEBAND

NC016 V.H.F. (*abbr.*) Abbreviation for VERY HIGH FREQUENCY. ↑ WAVEBAND

NC017 high frequency (*n.*) A frequency in the range 3000 to 30 000 kHz, *i.e.* corresponding to a wavelength in the range 100 m to 10 m. ↑ WAVEBAND

NC018 H.F. (*abbr.*) Abbreviation for HIGH FREQUENCY. ↑ WAVEBAND

NC019 medium frequency (*n.*) A frequency in the range 300 to 3000 kHz, *i.e.* corresponding to a wavelength in the range 1000 m to 100 m. The range of medium frequencies make up the medium waveband, which is used in broadcasting for local radio stations. ↑ WAVEBAND

NC020 M.F. (*abbr.*) Abbreviation for MEDIUM FREQUENCY. ↑ WAVEBAND

NC021 low frequency (*n.*) A frequency in the range 30 to 300 kHz, *i.e.* corresponding to a wavelength in the range 10 000 m to 1000 m. The range of low frequencies makes up the long waveband, which is used in local broadcasting, but to a lesser extent than the medium waveband. ↑ WAVEBAND

NC022 L.F. (*abbr.*) Abbreviation for LOW FREQUENCY. ↑ WAVEBAND

NC023 very low frequency (*n.*) A frequency below 30 kHz, *i.e.* corresponding to a wavelength above 10 000 m. ↑ WAVEBAND

NC024 V.L.F. (*abbr.*) Abbreviation for VERY LOW FREQUENCY. ↑ WAVEBAND

NC025 skip distance (*n.*) For each frequency of a radio wave, there is a minimum angle of incidence below which the wave is not reflected, but passes through the ionosphere and is transmitted to outer space. The minimum angle of incidence for reflection defines an area round a transmitting station, in which no sky wave is received. The minimum distance at which the sky wave is received is called the skip distance. ↓ FADING ↑ RADIO WAVES

NC026 fading (*n.*) The effect of fluctuation in intensity of the signal received by a radio receiver. Fading is particularly noticeable by day, and becomes less during the night. It is caused by interference between sky and ground waves and by changes in the electron density of the ionosphere. ↑ SKIP DISTANCE

NC027 microwaves (*n.pl.*) Electromagnetic waves with wavelengths ranging from 30 cm to 1 mm, *i.e* from very short radio waves to long infra-red waves. ↓ EXTREMELY HIGH FREQUENCY · E.H.F · SUPER HIGH FREQUENCY · S.H.F. · ULTRA HIGH FREQUENCY · U.H.F. ↑ RADIO WAVES

NC028 extremely high frequency (*n.*) A frequency in the range 30 000 to 300 000 MHz; *i.e.* corresponding to a wavelength in the range 1 cm to 1 mm. These frequencies are even more directional than super high frequencies. ↑ MICROWAVE

NC029 E.H.F. (*abbr.*) Abbreviation for EXTREMELY HIGH FREQUENCY. ↑ MICROWAVE

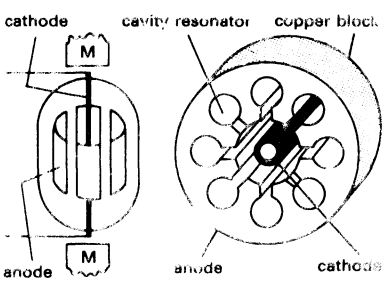
NC030 super high frequency (*n.*) A frequency in the range 3000 MHz to 30 000 MHz; *i.e.* corresponding to a wavelength in the range 10 cm to 1 cm. This is the waveband including 3 cm waves, which are highly directional. ↑ MICROWAVE

NC031 S.H.F. (*abbr.*) Abbreviation for SUPER HIGH FREQUENCY. ↑ MICROWAVE

NC032 ultra-high frequency (*n.*) A frequency in the range 300 MHz to 3000 MHz, *i.e.* corresponding to a wavelength in the range 1 m to 10 cm. ↑ MICROWAVE

NC033 U.H.F. (*abbr.*) Abbreviation for ULTRA-HIGH FREQUENCY. ↑ MICROWAVE

NC034 radar (*n.*) An acronym for Radio Detection and Ranging. Microwaves, of wavelengths in the range of centimetres, are generated and emitted in pulses modulated at a radio frequency. A movable aerial radiates a beam of the microwaves. An object, at a distance, in the path of the beam, reflects the waves. The transmitter also acts as a receiver and detects the reflected beam. The received signal is displayed on a cathode-ray tube, which is in the correct time sequence so that the time is measured between emission and reception. The distance of the object is thus known, and its direction is determined from the direction of the aerial. The system allows objects to be located accurately, whatever the weather conditions. It is used extensively for air and sea navigation, for tracking satellites and missiles, and is now used for automatic guidance whereby the received signal is not displayed, but used to control an aircraft. ↓ MAGNETRON · RADIO-FREQUENCY HEATING ↑ ELECTROMAGNETIC RADIATION

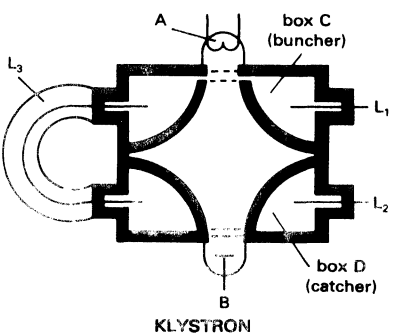


MAGNETRONS

NC035 magnetron (*n.*) A type of thermionic valve which produces oscillations of a very high frequency (of the order 10^7 kHz). It consists of a cathode placed centrally within a circular anode, the latter usually split into segments, and both enclosed in an evacuated tube; an electromagnet is situated so that its field is parallel to the cathode. The cathode can be a hot wire, or (more usually) a tube surrounding a heater. The cathode emits electrons which are attracted to the anode. The magnetic field causes the electrons to move in a curved path. With a strong magnetic field and a weak anode potential, the electrons do not reach the anode. By adjustment of the electric and magnetic fields, a high frequency oscillatory current is generated (see diagram). Magnetrons are used in radar circuits to generate microwaves. ↓ CAVITY MAGNETRON · RESONANT CAVITY · KLYSTRON · VELOCITY MODULATION · BUNCHER · CATCHER · CAVITY RESONATER ↑ RADAR

NC036 cavity magnetron (*n.*) A type of magnetron in which the anode consists of a circular block of copper with 8 holes situated radially round a central cavity; each hole is joined to the central cavity by a slot. A heated cathode is situated in the central cavity. The holes act as cavity resonators for the electrons emitted by the cathode (see diagram). ↑ MAGNETRON

NC037 resonant cavity (*n.*) A space enclosed by electrically conducting surfaces, which can both store and excite electromagnetic energy. Associated with the dimensions of the cavity is a resonant frequency, the frequency being in the microwave region. ↑ MAGNETRON



KLYSTRON

NC038 klystron (*n.*) A type of thermionic valve which amplifies, or can produce, oscillations of a high frequency in the microwave range. It consists of an electron gun, A, directing a stream of electrons towards a collecting plate, B; the stream passes through two boxes, C and D. Box C is connected to a circuit by L_1, which feeds in an oscillatory current; the box acts as a cavity resonator and sets up an oscillatory current. The electrons have their speeds changed, and are formed into bunches. Box C is called the **buncher.** The bunches of electrons set up an oscillatory current in box D, the **catcher**; this oscillatory current is led

away by lead L_2. This arrangement amplifies the original oscillatory current. If the buncher and the catcher are joined by a looped lead, L_3, the two boxes resonate, and an amplified oscillatory current is set up in the catcher and led away by lead L_2. Klystrons are used in radar circuits to amplify microwaves. ↑ MAGNETRON

NC039 velocity modulation (*n.*) The process of varying the velocity of a stream of electrons by alternately accelerating and decelerating them. This type of modulation is used in a klystron to set up an amplified oscillatory current. ↑ MAGNETRON

NC040 buncher (*n.*) The part of a klystron in which electrons are formed into bunches. ↑ MAGNETRON

NC041 catcher (*n.*) The part of a klystron in which an oscillatory current is set up by bunches of electrons. ↑ MAGNETRON

NC042 cavity resonator (*n.*) Alternative term for a RESONANT CAVITY (↑). ↑ MAGNETRON

NC043 radio-frequency heating (*n.*) An industrial process in which material to be heated is placed between the plates of a capacitor and subjected to an alternating current of frequency about 25kHz. Energy is lost from the alternating field to electrons in the atoms and molecules of the material. Also called ***dielectric heating.*** ↑ RADAR

NC044 cosmic rays (*n.pl.*) High energy radiation from outer space arriving at the Earth, consisting mainly, but not completely, of charged particles, and some gamma rays. The majority of the particles are protons, although some electrons and alpha particles are also present. A small fraction (~ 2%) of the particles are atomic nuclei. The radiation from space is called the primary radiation. The primary radiation produces secondary radiation when it hits the Earth's atmosphere. Collisions between protons and neutrons in the top tenth of the atmosphere cause mesons to be produced; these decay producing high-energy electrons. High-energy electrons are also produced by collisions between the primary protons and nuclei, and other types of collision. The high-energy electrons give rise to photons, positrons, and further electrons, called a cosmic ray shower, and the photons constitute cosmic rays of very high frequency and consequently very great penetrating power. The origin of the primary cosmic radiations is uncertain, but some appear to come from the sun. ↓ EAST-WEST ASYMMETRY · VAN ALLEN RADIATION BELTS · HODOSCOPE ↑ ELECTROMAGNETIC RADIATION

NC045 east-west asymmetry (*n.*) The effect in which the experimentally observed intensity of cosmic rays coming from the west is greater than that coming from the east, at whatever latitude the observations are made. This asymmetry of incidence arises because the primary radiation consists of charged particles which are deflected by the Earth's magnetic field, and the direction of the deflection indicates that the majority of particles are positively charged. An electromagnetic radiation would be unaffected by the Earth's magnetic field, and there would be no asymmetry. ↓ SHOWER ↑ COSMIC RAYS

NC046 shower (*n.*) The production of a large number of particles by one high energy particle. The high energy particle can come from a cosmic ray or from an accelerator. There are three types of showers. **1 Cascade showers** also known as ***soft showers,*** consist of electrons, positrons and photons; they are formed: ***a*** by radiative collisions; ***b*** by successive production of ion pairs; their penetrating power is low. **2 Penetrating showers** consist of nucleons and muons; they can penetrate lead to a depth of 20 cm. **3 Auger showers,** defined from the spread of the shower, can spread over an area of as much as 1000 m^2. ↑ EAST-WEST ASYMMETRY

NC047 van Allen radiation belts (*n.pl.*) Two belts of charged particles held within the Earth's magnetic field. The inner belt, between 2400 and 3600 km above the Earth's surface, is thought to consist of secondary charged particles produced by the collision of cosmic radiation with molecules in the Earth's atmosphere. The outer belt, between 13 000 and 19 000 km above the Earth's surface, is thought to contain charged particles originating from the sun. The existence of the two belts was discovered in 1958 from observations by artificial satellites and space probes. ↓ IONOSPHERE · D-REGION · E-REGION · F-REGION · HEAVISIDE-KENNELLY LAYER · APPLETON LAYER ↑ COSMIC RAYS

NC048 ionosphere (*n.*) The upper region of the Earth's atmosphere, between 50 and 400 km above the Earth's surface. It contains free electrons originating from ionization caused by ultraviolet radiation and X-rays from the sun. The ionosphere reflects radio waves, and also radiation from outer space. It is divided into three regions; the **D-region**, the **E-region** or Heaviside-Kennelly layer, and the **F-region** or Appleton layer. ↑ VAN ALLEN RADIATION BELTS

NC049 D-region (*n.*) A region of the ionosphere between 50 and 90 km above the Earth. ↑ VAN ALLEN RADIATION BELTS

NC050 E-region (*n.*) Alternative term for the HEAVISIDE-KENNELLY LAYER (↓). ↑ VAN ALLEN RADIATION BELTS

NC051 F-region (*n.*) Alternative term for the APPLETON LAYER (↓). ↑ VAN ALLEN RADIATION BELTS

NC052 Heaviside-Kennelly layer (*n.*) The E-region of the ionosphere between 90 and 150 km above the Earth's surface. It is also referred to as the Heaviside layer. At night the concentration of electrons in the region becomes lower, owing to recombination between ions ↑ VAN ALLEN RADIATION BELTS

NC053 Appleton layer (*n.*) A region of the ionsphere between 150 and 400 km above the Earth's surface. The layer remains almost at the same concentration of ions

throughout the night owing to the low concentration of ions and the low chance of collisions taking place. ↑ VAN ALLEN RADIATION BELTS

NC054 hodoscope (*n.*) An apparatus for following the track of a charged particle, usually a cosmic ray particle. ↑ COSMIC RAYS

NC055 radio-frequency radiation (*n.*) Electromagnetic radiation with the frequencies of radio waves. ↓ RADIO WINDOW · RADIO SOURCE ↑ ELECTROMAGNETIC RADIATION

NC056 radio window (*n.*) Radio-frequency radiation with wavelengths between 1 cm and 10 m reach the Earth's surface; the wavelengths are too long to be absorbed by the Earth's atmosphere and too short to be reflected by the ionosphere. This range of wavelengths is called the radio window. Radio-frequency radiations passing through the radio window originate from a variety of sources, *e.g.* bodies in the solar system and other radio sources. ↓ RADIO TELESCOPE · RADIO INTERFEROMETER · RADIO ASTRONOMY ↑ RADIO-FREQUENCY RADIATION

NC057 radio telescope (*n.*) An instrument to detect and analyze radio-frequency radiation from outer space. There are two basic principles of construction, *a* a parabolic reflector with a small aerial at the focus of the reflector; *b* a radio interferometer. The parabolic reflector can be aimed at any portion of space, and the electromagnetic waves are focussed on the aerial. A circuit connected to the aerial analyses the frequencies and intensities of the radio waves. The instrument is versatile owing to its great mobility. ↑ RADIO WINDOW

NC058 radio interferometer (*n.*) An instrument which operates on the same principle as the optical interferometer. It consists of two or more separate aerials joined to the same receiver. The distance between aerials depends on the wavelength to be analysed. The instrument can determine locations of sources with a greater degree of accuracy than the parabolic radio telescope, and it has a greater ability to detect a small source against an intense background of radio noise. This ability comes from the sensitivity to sources with small angular diameter. ↑ RADIO WINDOW

NC059 radio astronomy (*n.*) The study of radio-frequency radiation from heavenly bodies using radio telescopes and radio interferometers. Only such radiations as pass through the radio window can be detected and analysed. Radio-frequency radiation may arise from thermal or non-thermal causes; thermal emission originates from the quiet sun; non-thermal emissions originate from sunspots. The radio noise from space is located and maps of space constructed showing sources and their intensities. These maps are compared with astronomical maps based on optical observations. Radio astronomy has identified radio sources and radio galaxies which are not observable by optical methods ↑ RADIO WINDOW

NC060 radio source (*n.*) A discrete source of radio-frequency radiation outside the solar system. Such sources include supernovae explosions and their remnants, collisions between gas clouds, galaxies, quasars, and pulsars. There remain sources which as yet have no explanation. ↓ RADIO STAR · RADIO GALAXY · SYNCHROTRON RADIATION · PULSAR · QUASAR ↑ RADIO-FREQUENCY RADIATION

NC061 radio star (*n.*) An obsolete term for RADIO SOURCE (Sn) (↑).

NC062 radio galaxy (*n.*) A galaxy which emits radio-frequency radiation. The exact source of emission is not yet fully understood; evidence from optical observation indicates galaxies in collision produce radio-frequency radiation. ↑ RADIO SOURCE

NC063 synchrotron radiation (*n.*) **1** If high energy electrons within a synchrotron are accelerated in a strong magnetic field, they emit light and ultraviolet radiation; this emission is synchrotron radiation. **2** The emission of radio-frequency radiation from interstellar gas clouds in radio galaxies is also called synchrotron radiation, as this phenomenon is thought to be caused by the same process as that in the synchrotron. ↑ RADIO SOURCE → SYNCHROTRON

NC064 pulsar (*n.*) A type of star which pulsates energy. Pulsars emit brief pulses of radio-frequency radiation at regular intervals. Some pulsars have also been observed to emit regular pulses of light. It is suggested that such stars have consumed all their nuclear fuel and no longer have internal energy; they would be highly compressed, and would consist entirely of neutrons, apart from a thin outer shell. The pulses of radiation are thought to come from the rotation of the star. ↑ RADIO SOURCE

NC065 quasar (*n.*) Extra-galactic sources of high energy radio-frequency radiation; some of them also emit light. Quasars have only recently been detected, and their extremely high energy outputs have not yet been explained. ↑ RADIO SOURCE

NC066 quantum theory (*n.*) A theory first introduced by Planck to explain black-body radiation. He put forward the hypothesis that electromagnetic energy is emitted and absorbed in integral multiples of discrete units, *i.e.* energy is discontinuous. For each electromagnetic frequency there is an associated *packet* of energy, and amounts of energy, smaller than this packet, cannot be obtained. Compare **electric charge,** which is also discrete, in which a quantity of charge, smaller than the charge on an electron, cannot be obtained. ↓ BLACK-BODY RADIATION · QUANTUM MECHANICS · PHOTON · DUAL NATURE OF MATTER · WAVE MECHANICS · QUANTIZED ↑ ELECTROMAGNETIC RADIATION

NC067 black-body radiation (*n.*) The range of frequencies of electromagnetic waves emitted by an ideal emitter, which absorbs all radiations falling upon it The distribution of energy at different frequencies has a peak value (maximum intensity) at a given

frequency, and tends to zero at very high and very low frequencies. The frequency at maximum intensity depends only on the temperature (in Kelvin) and not on the material of the body. ↓ PLANCK'S LAW OF RADIATION · QUANTUM · PLANCK'S CONSTANT ↑ QUANTUM THEORY

NC068 Planck's law of radiation (*n.*) The law that the energy of all electromagnetic radiations is composed of discrete quanta, the magnitude of which is determined by the product of a constant and the frequency of the radiation. (The wavelength can change in a dispersive medium, but the frequency and hence the magnitude of a quantum remains the same.) ↑ BLACK-BODY RADIATION

NC069 quantum (*n., pl.* **quanta**) The smallest "unit" of energy that can be obtained from an electromagnetic radiation of a given frequency. The energy of an electromagnetic radiation is always a multiple of a quantum. ↑ BLACK-BODY RADIATION

NC070 Planck's constant This constant determines the relation between frequency and the magnitude of a quantum; its symbol is h. For a frequency, ν (the Greek letter nu), a quantum of energy is $h\nu$. The accepted value for h is $6{\cdot}625 \times 10^{-34}$ J s. For monochromatic light of wavelength 589 nm (in a vacuum), the frequency is $5{\cdot}069 \times 10^{14}$ Hz, and the magnitude of 1 quantum, $h\nu$, is $5{\cdot}069 \times 10^{14} \times 6{\cdot}625 \times 10^{-34} = 3{\cdot}37 \times 10^{-19}$ J. ↑ BLACK-BODY RADIATION

NC071 quantum mechanics (*n.sing*) A system of mechanics developed from the quantum theory for the study of physical phenomena occurring on the atomic and molecular scale of size; classical mechanics is not suitable. The system interprets atomic and molecular spectra on the basis of quantized energy. There are several forms of quantum mechanics; the commonest is wave mechanics. ↓ BOHR'S THEORY · QUANTUM NUMBER · PRINCIPAL QUANTUM NUMBER · AZIMUTHAL QUANTUM NUMBER · MAGNETIC QUANTUM NUMBER · SPIN QUANTUM NUMBER · RELATION OF QUANTUM NUMBERS · PAULI'S EXCLUSION PRINCIPLE ↑ QUANTUM THEORY

NC072 Bohr's theory (*n.*) A theory to explain the structure of the spectrum of the hydrogen atom; it is based on three postulates that, *a* extranuclear electrons revolve in orbits around the nucleus of an atom without radiating energy in the form of electromagnetic waves; each possible orbit is a stationary state; *b* the angular momentum of an electron in its stationary state is an integral multiple of $h/(2\pi)$, where h is Planck's constant; each stationary state has its own level, and all the levels are quantized; *c* emission or absorption of radiation occurs when an electron jumps from one stationary state to another, if an electron jumps from a stationary state of energy E_1 to one of energy E_2, the electromagnetic radiation emitted has a frequency ν (the Greek letter nu) given by:

$$h\nu = E_1 - E_2$$

The theory has now been superseded by wave mechanics. ↑ QUANTUM MECHANICS

NC073 quantum number (*n.*) An integer or half integer used to specify the energy level of an extranuclear electron in an atom. There are four such numbers: **1** principal quantum number (symbol: n); **2** azimuthal quantum number (symbol: l); **3** magnetic quantum number (symbol: m or m_l); **4** spin quantum number (symbol: s or m_s). ↑ QUANTUM MECHANICS

NC074 principal quantum number (*n.*) The number that defines the electron shell. $n = 1$ defines the K-shell; $n = 2$ defines the L-shell; $n = 3$ defines the M-shell. ↑ QUANTUM MECHANICS

NC075 azimuthal quantum number (*n.*) The number that defines the wave shape for an electron orbital. $l = 0$ defines an *s*-orbital; $l = 1$ a *p*-orbital; $l = 2$ a *d*-orbital. For a given value of n, l can have values from 0 to $n - 1$. Thus, $n = 1$, $l = 0$; $n = 2$, $l = 1$ or 0; $n = 3$, $l = 2$, 1, or 0. ↑ QUANTUM MECHANICS

NC076 magnetic quantum number (*n.*) The number that describes the splitting of spectral lines in a magnetic field; it defines the magnetic moment of an orbital, *i.e.* the way in which an orbital aligns itself in a magnetic field. For a given value of l, m can have integral values between $+l$ and $-l$. Thus, $l = 2$, $m = +2$, $+1$, 0, -1, and -2. ↑ QUANTUM MECHANICS

NC077 spin quantum number (*n.*) The number that describes the spin of an electron; it is assigned the values of $+\frac{1}{2}$ or $-\frac{1}{2}$. Any one orbital, as defined by the other three quantum numbers, can be occupied by two electrons with opposing spins ($+\frac{1}{2}$ and $-\frac{1}{2}$); these are paired electrons. ↑ QUANTUM MECHANICS

NC078 relation of quantum numbers (*n.*) In an *s*-orbital: $l = 0$; $m = 0$; $s = +\frac{1}{2}$ or $-\frac{1}{2}$. ∴ 2 electrons. In *p*-orbitals: $l = 1$; $m = +1$, 0, -1. ∴ 3 orbitals with $s = +\frac{1}{2}$ or $-\frac{1}{2}$ in each, *i.e.* 6 electrons. In *d*-orbitals: $l = 2$; $m = +2$, $+1$, 0, -1, -2. ∴ 5 orbitals with $s = +\frac{1}{2}$ or $-\frac{1}{2}$ in each, *i.e.* 10 electrons. ↑ QUANTUM MECHANICS

NC079 Pauli's exclusion principle (*n.*) The principle that no two electrons in an atom can have the same four quantum numbers. ↑ QUANTUM MECHANICS

NC080 photon (*n.*) A quantum of electromagnetic radiation, the magnitude of which is obtained from the product of Planck's constant and the frequency of the radiation. A photon can be regarded, in some contexts, as an elementary particle; it is then considered to have zero rest mass, a constant velocity of 3×10^8 m s^{-1} and no charge, and to change its momentum by altering the associated frequency. Photons are generated when an electric charge is in collision with nuclei or electrons, and the electric charge changes its momentum. The lost momentum appears as a photon. Photons are also generated in the decay of radioactive nuclei and in the decay of unst-

able fundamental particles. Photons are generally considered, in a narrow sense, to be quanta of light; they have the constant velocity of light in a vacuum. A simple explanation of group velocity is given by saying a photon traversing a medium is absorbed, and later re-emitted; when travelling at all, it is at $3{\cdot}00 \times 10^8\,m\,s^{-1}$, but with absorption and re-emission, its mean velocity is less and is actually equal to the group velocity. ↓ COMPTON EFFECT ↑ QUANTUM THEORY → PHOTO-ELECTRIC EFFECT

NC081 Compton effect When monochromatic electromagnetic radiation is scattered by matter, the scattered radiation has a lower frequency. With light, the effect is not detectable; with X-rays, a modified frequency is clearly apparent; with gamma radiation, the modified frequency has a greater intensity than the original frequency. The effect is explained by the collision between a photon and an electron; the photon loses momentum and the electron gains momentum. The momentum of a photon is derived from:

energy of photon $= E = h\nu$

but $E = mc^2$

$\therefore\ mc^2 = h\nu$

and the mass of a photon $= \dfrac{h\nu}{c^2}$

momentum of a photon = mass × velocity

$$= \frac{h\nu}{c^2} \times c$$

$$= \frac{h\nu}{c}$$

If the original frequency is ν_0 and the modified frequency is ν, then:

$$\text{loss of momentum} = \frac{h}{c}(\nu_0 - \nu)$$

i.e. the frequency is less after scattering, a result shown by experiment. ↑ PHOTON

NC082 dual nature of matter (*n.*) If experimental observations are made to find and determine the properties of a particle, such as an electron, the result is successful, although the particle never has its position and velocity recorded at the same time. If experimental observations are made to find and determine the properties of a wave of matter, such as a beam of electrons, the result is successful, although the results only indicate wave-like properties, *e.g.* interference; no waves are revealed as ripples in a medium. Matter has a dual nature; it can act as if it has a particulate nature or a wave nature. The particulate nature is studied in particle mechanics based on the quantum theory; the wave nature is studied in wave mechanics. Analogies of the two systems are shown in the diagram in the next column.

↓ UNCERTAINTY PRINCIPLE · PRINCIPLE OF COMPLEMENTARITY · INDETERMINANCY PRINCIPLE ↑ QUANTUM THEORY

General speech	Brightness	Quality (colour)
Particle mechanics	Particle density	Particle energy
Wave mechanics	Amplitude	Frequency

NC083 uncertainty principle (*n.*) An assumption, made by Heisenberg, that owing to the dual nature of particles, it is not possible to determine at one and the same time the precise position and the precise momentum of a particle. The more accurately one quantity is determined, the less accurately the other quantity can be determined. The limit of accuracy in measurements of these two quantities is given by Planck's constant (h). If the range in values for position is Δp and str momentum is Δq then the uncertainty principle states

$$\Delta p \times \Delta q = h.$$

A similar statement can be made for energy and time, *i.e.* $\Delta E \times \Delta t = h$, relative to a particle in motion. Arising from the uncertainty principle, an orbit or path of a particle, such as an electron, cannot be determined with precision. With regard to electrons in atoms, only the probability of locating an electron in an atom can be given with precision. ↑ DUAL NATURE OF MATTER

NC084 principle of complementarity (*n.*) The principle, put forward by Bohr, that the behaviour of matter as waves and the behaviour of matter as particles are complementary. No experiment reveals both types of behaviour at the same time; in some experiments matter behaves as a wave, in others as particles. The difficulty arises from use of the terms *particle* and *wave*, both of which have interpretations which are physical. In scientific theories, these terms are only analogies, and when the analogies are taken too far, the predictions break down. It is better to treat the two aspects of matter mathematically. ↑ DUAL NATURE OF MATTER

NC085 indeterminancy principle (*n.*) Alternative term for UNCERTAINTY PRINCIPLE (↑).

NC086 wave mechanics (*n.*) A development of quantum mechanics in which extranuclear electrons are not treated as particles moving in orbits, but as 3-dimensional stationary waves in space, represented by a wave function, ψ (the Greek letter psi). This theory of the structure of atoms, and hence of matter, is based on the postulate that any moving particle, whatever its nature, has wave properties associated with it, and correspondingly any wave motion has associated with it particle properties, *i.e.* quanta. Evidence for this postulate is given by an experiment in which a narrow beam of electrons can be diffracted by a metal crystal in a manner similar to X-rays. ↓ DE BROGLIE'S EQUATION · WAVE FUNCTION ↑ QUANTUM THEORY

NC087 de Broglie's equation (*n.*) Any moving particle has associated with it properties of a wave nature. A particle of mass m moving with a velocity v has an associated wavelength (λ) given by:

$$\lambda = \frac{h}{mv} \text{ where } h \text{ is Planck's constant.}$$

The equation is based on the supposition that the momentum of a particle (mv) is the same as the momentum of a wave motion (h/λ), *i.e.*

$$mv = h/\lambda. \therefore \lambda = h/mv.$$

↑ WAVE MECHANICS

NC088 wave function (*n.*) The magnitude of the wave function (ψ) represents the varying amplitude of the stationary wave system, in 3-dimensions, of an electron situated around a nucleus. Associated with the stationary wave is a frequency, ν. ψ^2 is the density of electrons per unit volume. $\psi^2 dV$ is the probability of finding the electron, when it is considered as a particle, in a volume dV; the total volume of the orbital gives a probability of unity. The effective electric charge associated with a volume dV is $-e\psi^2 dV$, where e is the charge on an electron. The four quantum numbers define possible states of the stationary waves. ↑ WAVE MECHANICS

NC089 quantized (*adj.*) Describes a physical quantity that exists only in discrete units. A value smaller than this discrete unit cannot exist, *e.g.* *a* the energy levels of extranuclear electrons are quantized; *b* electromagnetic radiations are quantized as photons. ↑ QUANTUM THEORY

Light

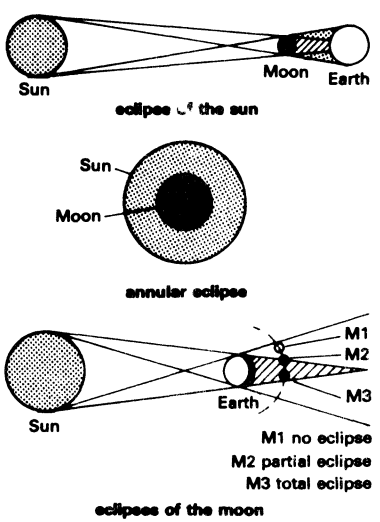
ND001 source² See **source¹ (AH012).**

ND002 rectilinear propagation (*n.*) The propagation of radiation in straight lines, especially light (visible radiation). ↑ SOURCE²

ND003 shadow (*n.*) A dark area produced when an opaque object is placed in the path of a beam of light. If a divergent beam of light from a point source is used, the appearance on a screen will be of a uniform dark area surrounded by light. ↑ SOURCE²

ND004 umbra (*n.*) If an extended source instead of a point source is used and an obstacle is placed in the beam, two areas can be seen in the shadow. The darker area is called the umbra. ↑ SHADOW · SOURCE²

ND005 penumbra (*n.*) If an extended source is used and an obstacle placed in the beam, two areas will be seen in the shadow. The outer, less dark area is called the penumbra. ↑ SHADOW · SOURCE²



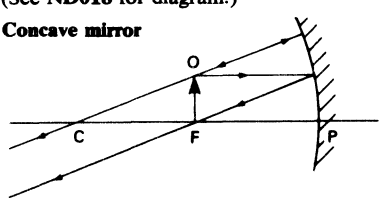
ECLIPSES

ND006 eclipse (*n.*) Light comes to the Earth from the sun. The moon moves round the Earth. There are occasions when the moon will be in the path of light from the sun to the Earth. On those occasions a shadow of the moon will be formed on the Earth and in those areas the sun's light will be cut off. Depending on the distance of the moon from the Earth on these occasions there will be either umbra and penumbra, or penumbra only. ↑ SOURCE²

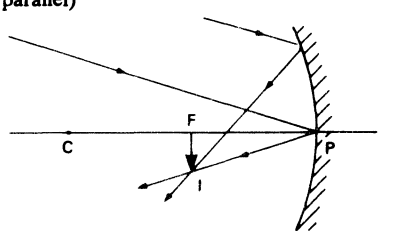
ND007 image (*n.*) A copy, either solid or optical, of an object. In optics, an image is a copy produced by a mirror, or lens, of an object placed in front of it. It may be real or virtual; the same size, diminished, or magnified; erect, or inverted.

Plane mirror: the image produced by a plane mirror is always the same size as the object, the same distance behind the mirror as the object is in front, laterally inverted. (See **ND018** for diagram.)

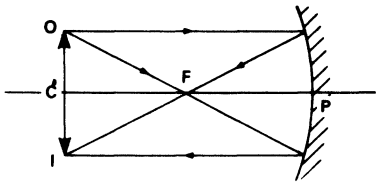
Concave mirror



object at F: image at inifinity (*i.e.* beam parallel)

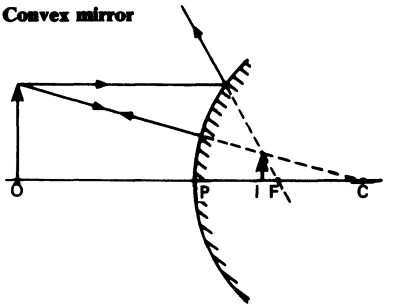


object at infinity (*i.e. beam parallel*): image at F, real, inverted, diminished

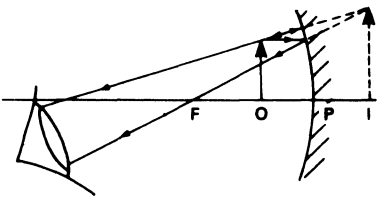


object at C: image is at C, real, inverted, same size

Convex mirror

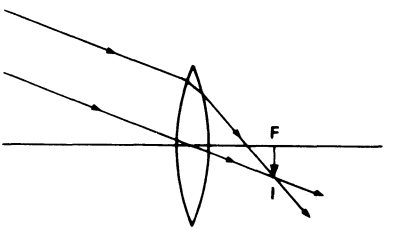


The image produced by a convex mirror is always virtual, erect, diminished.

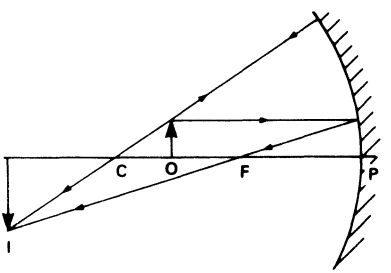


object between F and P: image is behind mirror, virtual, erect, magnified

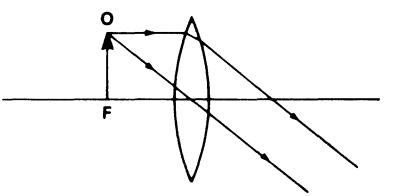
Convex lens



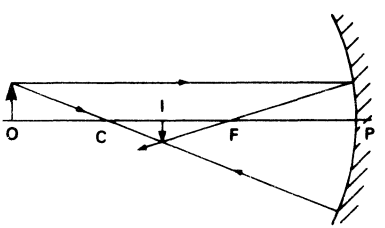
object at infinity (i.e. parallel beam): image is at F, real, inverted, diminished



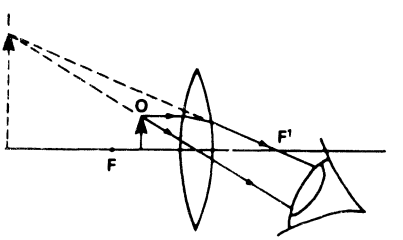
object between F and C: image is beyond C, real, inverted, magnified



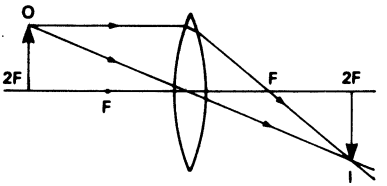
object at F: image is at infinity



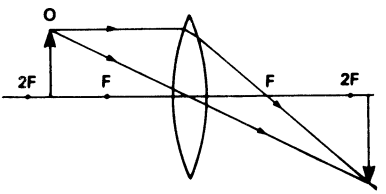
object beyond C: image is between C and F, real, inverted, diminished



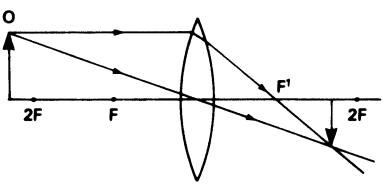
object between F and lens: image is behind the object, virtual, erect, magnified



object at 2F: image is at 2F, real, inverted, same size

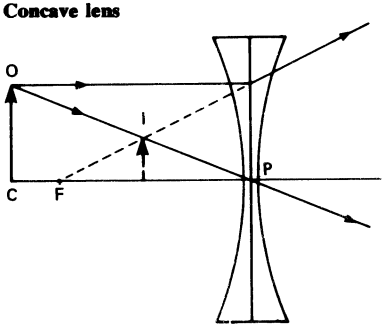


object between F and 2F: image is beyond 2F, real, inverted, magnified



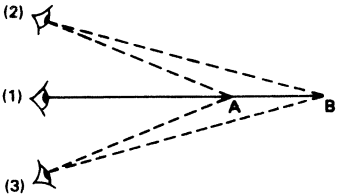
object beyond 2F: image is between F and 2F, real, inverted, diminished

Concave lens



The image produced by a concave lens is always virtual, erect, diminished. ↓ PARALLAX · MAGNIFICATION² → LIGHT

ND008 parallax (*n.*) If two objects are in line with the eye and the eye is moved to one side then the two objects appear as separate objects.



PARALLAX

With eye in position (2) A now appears to be to the right of B. With the eye in position (3) B now appears to be to the right of A. The points A and B exhibit parallax with respect to the observer. If A and B coincide there will be a situation of no-parallax. ↑ IMAGE

ND009 magnification² (*n.*) The magnifying power of an optical instrument or lateral magnification of an image. If the former is the case it is the angle subtended by the image α_i seen through the instrument to the angle subtended by the object α_o at a distance of 25 cm for microscopes and in situ for telescopes.

$$m = \frac{\alpha_i}{\alpha_o}$$

Lateral magnification is the height of image over height of object, $m = \frac{h_i}{h_o}$. It can be shown that m

$$= \frac{\text{image distance from mirror or lens } (v)}{\text{object distance from mirror or lens } (u)}$$

—MAGNIFY (*v.*) MAGNIFIED, ***magnifying*** (*adj.*) ↑ IMAGE

ND010 subtended angle (*n.*) In a triangle the side opposite an angle subtends the angle. In a right-angled triangle the hypotenuse subtends the right angle. One may say of the angle that it is subtended by the hypotenuse. It can also be said that the right angle is the angular subtense of the hypotenuse. An image subtends an angle ω at the eye, *i.e.* the angular subtense is ω. The sun subtends a small angle at an observer on the earth. The apparent size of the sun depends upon the angle it subtends at the eye. ↑ IMAGE

ND011 angular magnitude (*n.*) The angular magnitude of an object is the angle it subtends at the eye. We know that the diameter of the sun is 865 400 miles (approx. 10^4 times that of the Earth). When it is seen by an observer with the naked eye it is a comparatively small circle. The size of an object as seen by the eye depends upon the angle the object subtends at the eye. A row of telegraph poles seen one behind the other appear to grow smaller; they are in fact, if measured, the same size. The further away, the smaller the angle they subtend at the eye. ↑ IMAGE

ND012 screen[1] (*n.*) Any surface on which an image from a lens, or system of lenses, can be formed. Screens are usually sheets of white cloth, specially prepared surfaces on walls, white cards, sheets of translucent paper or ground glass. ↑ IMAGE

ND013 luminescence (*n.*) **1** Any process which involves the emission of light by a substance. **2** The light emitted in this way. —***luminescent*** (*adj.*) ↓ FLUORESCENCE · PHOSPHORESCENCE · CHEMILUMINESCENCE → LIGHT

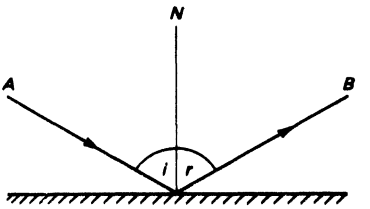
ND014 fluorescence (*n.*) The radiation of emitted light by a substance while it is irradiated by light or other radiation. The wavelength of the emitted light is different and usually longer than the wavelength of the exciting radiation. When ultraviolet light falls upon fluorescent materials, visible light is emitted, *e.g.* quinine sulphate solution under ultraviolet light fluoresces blue. In fluorescent lighting, the ultraviolet light inside the tube causes the outer casing to fluoresce. —***fluorescent*** (*adj.*) ↑ LUMINESCENCE

ND015 phosphorescence (*n.*) **1** When a substance is irradiated and continues to emit light after the exciting radiation has ceased, the process is called phosphorescence. The length of time of the phosphorescence varies. **2** Light emitted in this way. Calcium sulphide and zinc sulphide are examples of phosphorescent materials. —***phosphorescent*** (*adj.*) ↑ LUMINESCENCE

ND016 chemiluminescence (*n.*) **1** The process of emitting light during certain chemical processes, notably the slow oxidation of phosphorus. **2** Light emitted in this way. The glow of phosphorus vapour in air is chemilumine·scence produced by oxidation. —***chemiluminescent*** (*adj.*) ↑ LUMINESCENCE

ND017 reflection[1] (*n.*) The process by which a beam of radiation, such as light, may be deviated and reversed in direction by an opaque surface. If the surface is smooth, reflection is regular; if the surface is rough, the reflection is diffuse. Reflection can also take place at the interface between two media of different refractive index. Not all the radiation is reflected; some may be refracted. When the radiation passes from a dense to a less dense medium, total reflection may take place. Depending upon the nature of the beam of radiation, some wavelengths may be absorbed and others reflected. Thus when white light is incident on a red surface, the red wavelengths are reflected and others are absorbed. —***reflectivity*** (*n.*) REFLECT (*v.*) ***reflected, reflecting*** (*adj.*) ↓ LAWS OF REFLECTION · POLE[3] · PERISCOPE · REFLECT[2] → ABSORPTION (I) · REFRACTION[1] (I) · IMAGE

ND018 laws of reflection (*n.pl.*) The laws that **1** the incident ray (*A*), the reflected ray (*B*), and the normal (*N*) at the point of incidence, all lie in the same plane, **2** the angle of incidence (*i*) is equal to the angle of reflection (*r*). ↓ INCIDENCE · REFLECTOR · REFLECTION FACTOR · MIRROR · CONVEX MIRROR · CONCAVE MIRROR · MIRROR FORMULA ↑ REFLECTION[1]



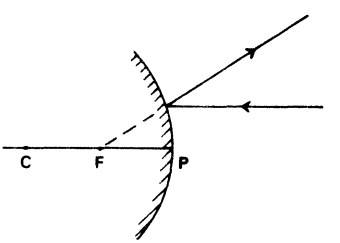
REFLECTION FROM A PLANE MIRROR

ND019 incidence (*n.*) The action of radiation or a moving body arriving at or falling on a surface. —***incident*** (*adj.*) ↑ LAWS OF REFLECTION

ND020 reflector (*n.*) An object or surface which reflects waves. The term can be applied to an object or surface which reflects light or an object or surface which reflects sound. ↑ LAWS OF REFLECTION

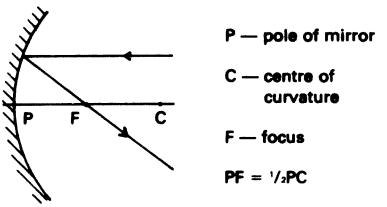
ND021 reflection factor (*n.*) The reflection factor of a surface is the ratio of the luminous flux reflected by the surface to the luminous flux incident upon the surface. The reflection factor varies with the wavelength of the radiation incident on the surface. ↑ LAWS OF REFLECTION

ND022 mirror (*n.*) An optical device for producing reflection. The surface may be plane or spherical. Other surfaces of revolution can be used, such as paraboloidal and elliptical surfaces. A mirror must have a high reflection factor. The reflection must be regular and specular, *e.g.* a piece of glass silvered on one side, or a polished sheet of silver, form a mirror. —***mirror*** (*v.*) ***mirrored*** (*adj.*) ↑ LAWS OF REFLECTION



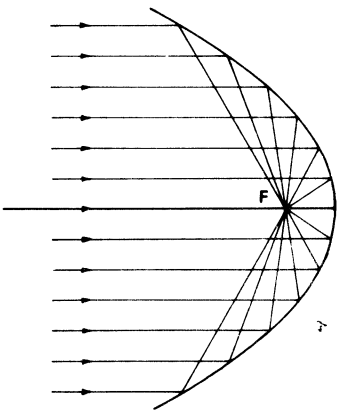
CONVEX MIRROR

ND023 convex mirror (*n.*) A mirror which is a part of a sphere with the silvering on the inside surface. A convex mirror is a diverging mirror. (See next entry for P, F, and C.) ↑ LAWS OF REFLECTION → CONVEX LENS



CONCAVE MIRROR

ND024 concave mirror (*n.*) A mirror which is a part of a sphere, with the silvering on the outside surface. A concave mirror is a converging mirror. ↑ LAWS OF REFLECTION → CONCAVE LENS



REFLECTION IN A PARABOLIC MIRROR

ND025 parabolic mirror (*n.*) When a parabola is rotated about its axis a surface is generated. Such a surface suitably silvered on the inside may be used as a mirror. Light from a source at the focus of the parabola will be reflected as a parallel beam. ↑ LAWS OF REFLECTION

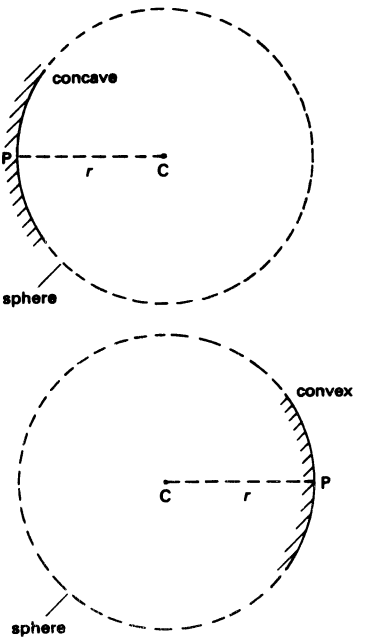
ND026 mirror formula (*n.*) The mirror formula is:

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$

Where u is the distance of the object from the mirror, v is the distance of the image, and f is the focal length. The same convention can be used as in the lens formula. Using **New Cartesian** the focal length for a concave mirror is negative, and for a convex mirror it is positive. Using **Real is Positive** a concave mirror has a real principal focus and a positive focal length, while a convex mirror has a virtual principal focus and a negative focal length. ↑ LAWS OF REFLECTION

ND027 pole[3] (*n.*) The pole of a mirror is the mid-point of the reflecting surface. ↓ CENTRE OF CURVATURE · RADIUS OF CURVATURE · FOCAL LENGTH[1] · CONJUGATE FOCI ↑ REFLECTION[1] → PRINCIPAL FOCUS

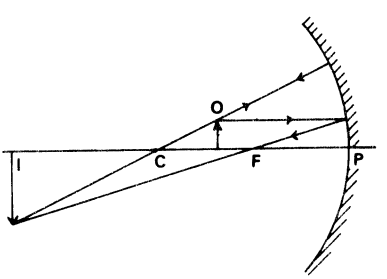
ND028 centre of curvature (*n.*) The centre of curvature of a mirror is the centre of the sphere of which the mirror is a part. It is thus equidistant from all points on the mirror surface. In the case of a convex mirror the centre of curvature is behind the mirror. ↑ POLE[3]

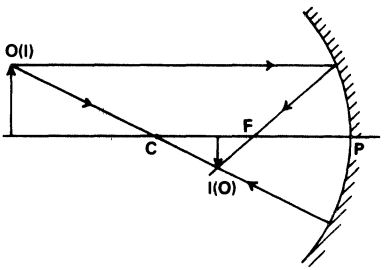


CENTRE OF CURVATURE

ND029 radius of curvature (*n.*) The radius of curvature is the distance (r) from the pole of the mirror (P) to the centre of curvature (C). ↑ CENTRE OF CURVATURE

ND030 focal length[1] (*n.*) The focal length of a mirror is the distance between the pole and the principal focus. For a spherical mirror of small aperture the focal length is half the radius of curvature of the mirror. ↑ POLE[3] · MIRROR FORMULA





CONJUGATE FOCI

ND031 conjugate foci (*n.pl.*) (Of a mirror or a lens) two points such that a source at one is brought to focus at the other, and vice versa. ↑ POLE[3] → PRINCIPLE OF REVERSIBILITY OF LIGHT

ND032 reflecting surface (*n.*) An interface between two media of different refractive index or between a medium, such as air, and an opaque surface, *e.g.* ***a*** silvered glass is a reflecting surface; ***b*** the air/glass interface and the glass/air interfaces may be reflecting surfaces. Some bright but irregular surfaces are also reflecting, but the reflection is diffuse. ↑ POLE[3]

ND033 periscope (*n.*) An optical device which allows an observer to see over an obstacle. It operates with two plane mirrors inclined at 45° and parallel to one another. Their reflecting surfaces are opposite one another. A more sophisticated form of the device uses isosceles right-angled prisms instead of mirrors, sometimes incorporating a telescope. ↑ REFLECTION[1] → STROBOSCOPE

ND034 reflect[2] (*v.t.,i.*) **1** (*v.t.*) To return a beam of radiation, causing it to return to the medium from which it started. **2** (*v.i.*) (Of a beam of radiation) to return at an interface between two media. ***—reflection,*** REFLECTOR (*n.*) REFLECTING, ***reflected*** (*adj.*) ↑ REFLECTION[1] · MIRROR

ND035 reflecting (*adj.*) Describes a surface which reflects light or other waves. The term also describes a device or instrument which uses reflections, *e.g.* ***a*** the surface of mercury is a reflecting surface; ***b*** a reflecting telescope contains a mirror which reflects and focuses the light from distant objects. ↓ REGULAR[3] · SPECULAR · DIFFUSE[2] · TOTAL[2]

ND036 regular[3] (*adj.*) Describes the type of reflection obtained from a homogeneous, continuous surface. A parallel beam is reflected as a parallel beam and there is no scattering of light. The reflection from a sheet of highly polished plane glass which has been silvered will be regular reflection. ↑ REFLECTING

ND037 specular (*adj.*) Describes a type of reflection which results in the formation of an image. When an object is placed in front of a concave mirror, between the principal focus and centre of curvature, specular reflection takes place. ↑ REFLECTING

ND038 diffuse[2] (*adj.*) Describes reflection which is irregular. The light is scattered in all directions because the surface is uneven and provides a very large number of tiny reflecting surfaces. A sheet of paper or a sheet of ground glass produces diffuse reflection. Even a piece of coloured material, such as wool, must be reflecting in order to be coloured. The reflection is diffuse. ↑ REFLECTING

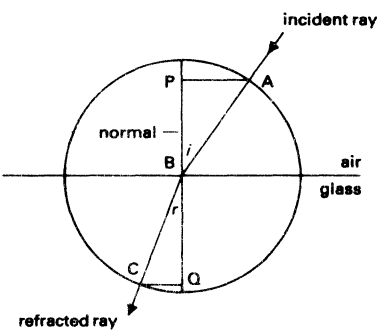
ND039 total[2] (*adj.*) Describes reflection in which all the incident radiation is reflected. Such a state of affairs is rarely achieved. Polished silver reflects a very high percentage of incident light. ↑ REFLECTING

ND040 refraction[1] (*n.*) The process which takes place when a ray of light, or other electromagnetic radiation, passes from a less dense to a denser medium, *e.g.* from air to glass. If the direction of the ray is normal to the surface, it passes through without change of direction. If the direction of the ray is at an angle to the normal then the ray will be deflected towards the normal. This process of deflection of a ray by a material medium is called refraction. The waves in the medium are deflected because the velocity of the waves in the medium is less than their velocity in air. ***—refract*** (*v.*) ***refracted*** (*adj.*) ↓ SNELL'S LAW · LENS[2] · FOCUS[2] · LENS FORMULA · DEVIATION · FOCUS[3] · CONVERGING → LIGHT

ND041 Snell's laws (*n.*) The laws that, **1** the incident ray, the refracted ray, and the normal are in one plane; the incident ray and refracted ray are on opposite sides of the normal at the point of incidence; **2** the ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant:

$$\frac{PA \times CB}{AB \times QC} = \frac{\sin i}{\sin r} = \text{constant } n$$

↓ REFRACTIVE INDEX · ABSOLUTE REFRACTIVE INDEX · TOTAL INTERNAL REFLECTION · CRITICAL ANGLE · REFRACTOMETER · APPARENT DEPTH ↑ REFRACTION[1]



SNELL'S LAWS

ND042 refractive index (*n.*) Snell's law states $\frac{\sin i}{\sin r}$ = constant for a given medium where i and r are the angles of incidence and refraction respectively. This constant is called the refractive index (n). Unless otherwise stated it is a property of the medium with respect to air as unity. The symbol may be written ${}_{a}n_{g}$, meaning refractive index air to glass. If the value of n is determined for a particular frequency, *e.g.* the sodium D line, then the refractive index is written as n_D. It can be shown also that for a given frequency $n = v_1/v_2$, where v_1 is velocity of light in air and v_2 is velocity of light in the medium. ↑ SNELL'S LAWS

ND043 absolute refractive index (*n.*) The value of the constant for a given medium with reference to a vacuum. The absolute refractive index for vacuum/air is 1·00028. To obtain the absolute refractive index for vacuum/glass, ${}_{a}n_{g}$ is multiplied by 1·00028. ↑ SNELL'S LAWS

ND044 total internal reflection (*n.*) When light passes through a rectangular glass block at an angle to the normal some light will be reflected from the glass surface at the air/glass boundary and some also at the glass/air boundary when the ray leaves the glass. This latter reflection is called internal reflection. If the passage of light from glass to air (dense to less dense medium) is examined, it is seen that what was the angle of refraction at the first surface (air to glass) becomes the angle of incidence at the second surface glass to air. If the angle of incidence is increased to the point where the angle of refraction is 90°, the emergent ray is parallel to the glass surface. If the incident ray (inside the glass) is now further increased all the light will be reflected. This is total internal reflection. ↑ SNELL'S LAWS

ND045 critical angle (*n.*) When a ray of light passes from a dense to a less dense medium so that the emergent ray is 90° to the normal, *i.e.* parallel to the medium/air interface, then the angle of incidence is called the critical angle. If the critical angle is exceeded, then total internal reflection takes place. The symbol for critical angle is c.

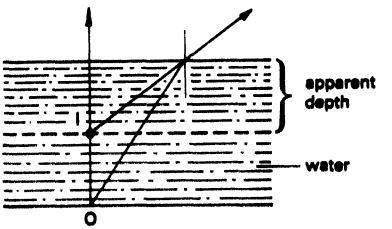
$${}_{g}n_{a} = \frac{1}{{}_{a}n_{g}} \qquad \frac{\sin c}{\sin 90°} = \frac{1}{{}_{a}n_{g}}$$

$${}_{a}n_{g} = \frac{1}{\sin c}$$

↑ SNELL'S LAWS

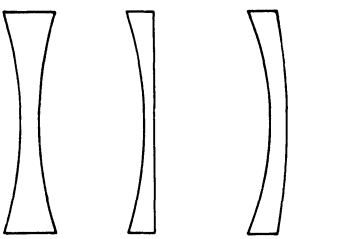
ND046 refractometer (*n.*) An instrument for the direct determination of the refractive index. It enables the identification of organic liquids to be made using the refractive index. ↑ SNELL'S LAWS

ND047 apparent depth (*n.*) An object in water, when viewed from above, appears to be a shorter distance below the water than it really is. The light from the object does not come directly to the eye but is refracted at the air/water boundary. It can be shown that real depth is n times the apparent depth, where n is the refractive index of water. ↑ SNELL'S LAWS



APPARENT DEPTH

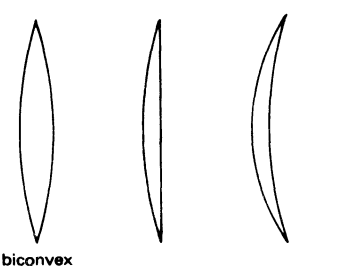
ND048 lens[2] (*n., pl.* **lenses**) A piece of transparent material bounded by spherical surfaces. Lenses are described by the nature of their boundary surfaces or by the effect they have on a beam of light. ↓ CONCAVE LENS · CONVEX LENS ↑ REFRACTION[1]



CONCAVE (DIVERGING) LENSES

ND049 concave (negative) lens (*n.*) This term is usually applied to a biconcave lens, *i.e.* a piece of transparent material bounded by two spherical surfaces. The surfaces curve inwards like the inside of a sphere. ↑ LENS[2]

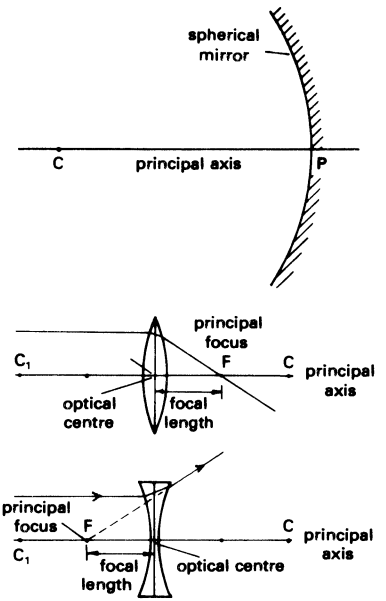
ND050 convex lens (*n.*) This term is usually applied to a biconvex lens, *i.e.* a piece of transparent material bounded by spherical surfaces. The surfaces curve outwards like the outside of a sphere. ↑ LENS[2]



CONVEX (CONVERGING) LENSES

ND051 positive lens (*n.*) A convex or converging lens. When using this term it is usual to describe the lens by its power, *e.g.* a converging lens of focal length 20 cm is a +5 lens. ↑ LENS

ND052 principal axis (*n.*) The line joining the centres of curvature of the surfaces of a lens. For a spherical mirror the principal axis is the line joining the pole of the mirror to the centre of curvature. ↑ LENS²



PRINCIPAL AXIS, OPTICAL CENTRE, PRINCIPAL FOCUS, FOCAL LENGTH

ND053 optical centre (*n.*) That point in a lens through which rays pass without deviation, but with displacement depending on the refractive index of the material and the thickness of the lens. The principal axis passes through the optical centre of the lens. ↑ LENS²

ND054 aperture¹ (*n.*) The diameter of a circle through which light is allowed to pass. For a lens without any reducing mechanism this is the diameter of the lens. In photography apertures may be varied. They are stated as fractions of the focal length, *e.g.* f/6 means that the diameter of the lens is 1/6 of the focal length. ↑ LENS²

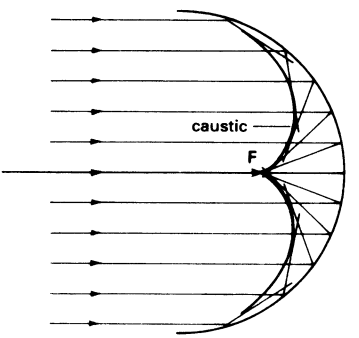
ND055 focus² (*n.,pl.* **foci**) A point to which rays (or a beam) converge or from which they appear to diverge after passing through a lens or after reflection at a mirror □ *rays are brought to a focus*—FOCUS (*v.*) ***focused*** (*adj.*) ↓ PRINCIPAL FOCUS · FOCAL PLANE · FOCAL LENGTH² · FOCAL DEPTH · ABERRATION ↑ REFRACTION¹

ND056 principal focus (*n.*) A principal focus of a lens is a point on the principal axis, to which all rays originally parallel and close to the axis converge, or from which they appear to diverge after passing through the lens. There are two of these for a lens. The principal focus of a mirror is similarly defined but there is only one. ↑ FOCUS²

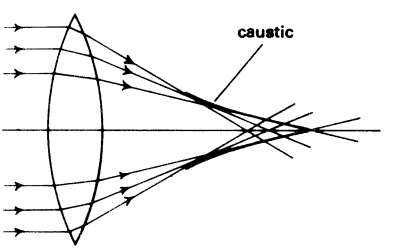
ND057 focal plane (*n.*) The focal plane is a focusing surface. It is the plane which is perpendicular to the principal axis and also passes through the principal focus. Rays parallel to each other, but at an angle to the principal axis, are brought to a focus in the focal plane. ↑ FOCUS²

ND058 focal length² (*n.*) The focal length of a lens is the distance between the optical centre of the lens and the principal focus. For a mirror the focal length is half the radius of curvature, *i.e.* $f = \frac{r}{2}$ ↑ FOCUS²

ND059 focal depth (*n.*) Every lens has a range of object positions which give an apparently focused image on a fixed screen. This range is called the **depth of focus** of the lens. If the principle is applied to the image, rather than the lens, the term **focal depth of the image** is used. ↑ FOCUS²



caustic curve from a wide aperture spherical mirror



caustic curve from a biconvex lens

ABERRATION

ND060 aberration (*n.*) In optics this term is applied to certain defects in images formed in optical systems. Aberration may be **spherical,** *e.g.* if the aperture of a concave spherical mirror is large, the rays at the

periphery are brought to focus nearer the mirror than those rays which meet the mirror near the pole, giving a curve known as the **caustic**. The spherical aberration arises from the properties of spherical surfaces. The same principle holds for lenses, with the effect that the image is distorted. The aberration in the case of lenses may also be **chromatic**—if the light contains more than one frequency, *e.g.* white light, dispersion takes place, since the lens is a series of small prisms: the image will therefore be coloured. ↑ FOCUS[2]

ND061 lens formula (*n.*) A formula connecting the object distance (u), image distance (v), and focal length (f) of a thin lens. Distances are measured from the optical centre. The lens formula has two forms depending on the sign convention used. The **New Cartesian** convention gives the formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

If a distance is measured against the incident light, it is positive. For a converging lens f is positive; for a diverging lens f is negative. The other convention is the **real is positive** convention. In this a converging lens (or mirror) has a positive focal length. Measurements from the lens (or mirror) are positive if they correspond to real objects or images. The formula is:

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

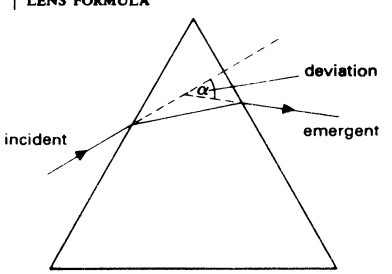
The formula here is the same for mirrors and lenses. ↑ REFRACTION[1]

ND062 dioptre (*n.*) A measure of curvature given as the reciprocal of the radius of curvature expressed in metres. The term was originally applied to a unit of measure of the power of a lens, equal to the reciprocal of the focal length measured in metres. ↑ LENS FORMULA

ND063 principle of reversiblity of light (*n.*) This principle states that paths of rays of light are reversible.

$$\text{If } {}_a n_g = \frac{\sin i}{\sin r}, \quad \text{then } {}_g n_a = \frac{\sin r}{\sin i}.$$

The refractive index for glass to air is the reciprocal of the refractive index for air to glass: ${}_a n_g$ is 1·5, ${}_g n_a$ is 0·67. ↑ LENS FORMULA



DEVIATION

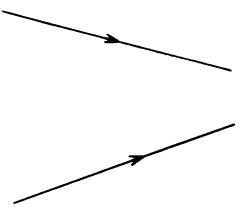
ND064 deviation (*n.*) The change in direction of a ray of light on passing through a transparent medium (block of glass) when the faces of the block are not parallel. The deviation is measured by the angle (α) between the incident ray and the emergent ray. Deviation takes place when a ray of light passes through a prism or a lens. —DEVIATE (*v.*) ***deviated*** (*adj.*) ↓ MINIMUM DEVIATION ↑ REFRACTION[1]

ND065 minimum deviation (*n.*) When the incident angle has the same value as the emergent angle, deviation is a minimum. If Δ is the angle of deviation, then, when Δ is a minimum,

$${}_a n_g = \frac{\sin \frac{1}{2}(A + \Delta)}{\sin \frac{1}{2}A}$$

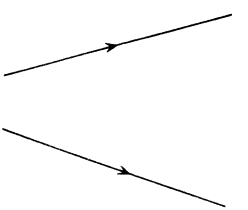
A is the vertical angle of the prism. ↑ DEVIATION

ND066 focus[3] (*v.t.*) **1** To cause a beam of radiation to converge to a point. **2** To adjust an optical instrument to produce a clear image. **3** To produce a clear image of an object using an optical system. —FOCUS (*n.*) ***focused, focal*** (*adj.*) ↑ REFRACTION[1] · LENS[2]



CONVERGING

ND067 converging (*adj.*) **1** Describes a beam of radiation, *e.g.* light, of steadily decreasing diameter, which appears to be directed to a point. **2** Describes a lens or mirror which produces this effect. A converging lens is a convex lens; a converging mirror is a concave mirror. —CONVERGENCE (*n.*) CONVERGE (*v.*) ***convergent*** (*adj.*) ↓ DIVERGING · ACHROMATIC ↑ REFRACTION[1]



DIVERGING

ND068 diverging (*adj.*) **1** Describes a beam of radiation, *e.g.* light, of steadily increasing diameter, which appears to be directed away from a point. **2** Describes a lens or

mirror which produces this effect. A diverging lens is a concave lens; a diverging mirror is a convex mirror. —***divergence*** (*v.*) DIVERGE (*v.*) DIVERGENT (*adj.*) ↑ CONVERGING

ND069 achromatic (*adj.*) A lens which with white light (or any non-monochromatic light) shows no chromatic aberration. It is a composite lens which consists of two or more lenses of different transparent materials having a different refractive index, *e.g.* crown glass and flint glass. One lens is converging, the other lens is diverging. In this way two colours, such as the red and blue, can be brought to focus together and chromatic aberration is eliminated. ↑ CONVERGING

ND070 real[2] (*adj.*) Describes an image that has been formed by the actual intersection of rays. It can be described as an image formed by converging rays. Such images can be formed on a screen. With a convex lens a real image is formed of an object placed beyond a principal focus. ↓ VIRTUAL · BLURRED · SHARP[2] ↑ REFRACTION[1] → REFLECTION[1]

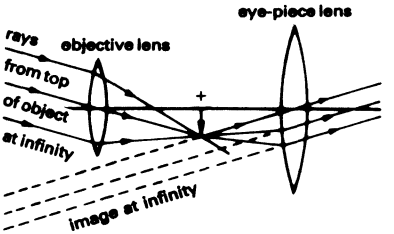
ND071 virtual (*adj.*) Describes an image formed by producing backways the rays of a diverging beam. These are in fact imaginary rays. In a mirror such an image is formed behind the mirror surface or in a lens on the same side as the object. A virtual image cannot be revealed by placing a screen at the apparent origin of the rays. Its position can be fixed by a no-parallax method. ↑ REAL[2]

ND072 blurred (*adj.*) Of indistinct appearance. Used of images formed by a lens or spherical mirror the term implies overlapping of images because of spherical aberration, or the formation of the image in a place other than the focal plane, *i.e.* the receiving screen is not in the focal plane. —***blur*** (*v.*) ***blur*** (*n.*) ↓ SHARP[2] (Ag) ↑ REAL[2]

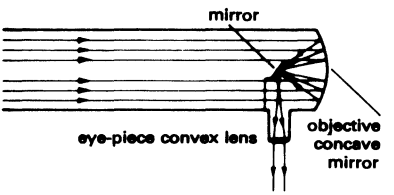
ND073 sharp[2] (*adj.*) Clear and well-defined; used of an image the term implies that the image is formed in the focal plane. An image is said to be sharp if overlap of images does not exceed 85 μm when viewed from 25 cm away. ↑ BLURRED (Ag)

ND074 optical instrument (*n.*) An instrument which makes use of the properties of mirrors, lenses, prisms, diffraction gratings, or combinations of these. The most important are the telescope, the microscope, the camera, the spectroscope, the spectrometer, the photometer and the spectrophotometer. They fall roughly into two classes, ***a*** those designed to help the human eye in the examination of objects, *e.g.* the telescope and microscope; ***b*** those designed to analyse light into its components, *e.g.* the spectrometer. ↓ TELESCOPE · MICROSCOPE

ND075 telescope (*n.*) A device for producing magnified images of distant objects. They may be **astronomical** or **terrestrial.** —***telescopic*** (*adj.*) ↓ ASTRONOMICAL TELESCOPE · TERRESTRIAL TELESCOPE · EYEPIECE · OBJECTIVE[2] ↑ OPTICAL INSTRUMENT



REFRACTING TELESCOPE



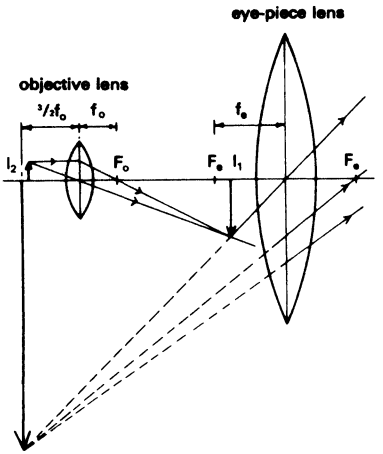
REFLECTING TELESCOPE

ND076 astronomical telescope (*n.*) **1 refracting telescope** This has a long focal length objective and a shorter focal length eye-piece. The eye-piece may be a convex or a concave lens. The former produces an inverted image which can be corrected by inserting another lens in the eye-piece. **2 reflecting telescope** To avoid chromatic aberration Newton used a concave mirror in place of the convex lens objective. For practical reasons very large telescopes of large diameter use mirrors. They collect more light and can be made more rigid. A radio telescope uses radio waves instead of light waves. ↑ TELESCOPE

ND077 terrestrial telescope (*n.*) This is a refracting telescope with an additional erecting lens system. Prisms may be used in certain types of instrument, *e.g.* binoculars. ↑ TELESCOPE

ND078 eye-piece (*n.*) A single lens or combination of lenses used to magnify the image formed by the objective in an optical instrument. The best arrangement is when the image formed by the objective is in the focal plane of the eye-piece. ↑ TELESCOPE

ND079 objective[2] (*n.*) The lens which is nearest to the object viewed in an optical instrument. Such a lens may be simple or compound. The design of the objective may vary according to the purpose for which it is used. It may be designed to correct spherical or chromatic aberration. Objectives may be low power (7·5 cm to 5 cm), medium power (2·5 cm to 1·75 cm), or high power (0·4 cm to 0·3 cm). Oil immersion objectives (0·2 cm) are used in microscopes. ↑ TELESCOPE



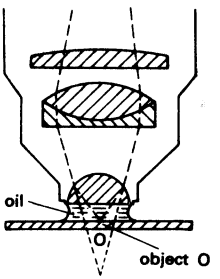
MICROSCOPE

ND080 microscope (*n.*) An optical system designed to observe very small objects which are often invisible to the naked eye and to produce a magnified image on the retina of the eye. This enables the eye to examine the details of the small object. The purpose is achieved by an objective of very short focal length which forms a magnified real image(I_1). This real image is magnified again by the eye-piece to form an even larger image(I_2). The total magnification for the microscope is the product of the objective magnification and the eye-piece magnification. ↓ RESOLVING POWER · OIL-IMMERSION OBJECTIVE ↑ OPTICAL INSTRUMENT

ND081 resolving power (*n.*) When two objects are close together they may not form two images on the retina of the eye which are distinguishable. The eye cannot distinguish two separate images for two objects if they are less than $^1/_{15}$ mm apart or if they subtend at the eye less than 1 minute of arc. The measure of ability to detect two such images of two objects close together is the resolving power of the instrument. For a telescope two objects are resolved if angular separation exceeds $0{\cdot}122\lambda/D$ seconds of arc, if D is the diameter of the objective in cm. For a microscope two objects are resolved if the angular separation of the objects is not less than λ/D where λ is the wavelength of the light used and D is the diameter of the objective. The least separation of two objects if they are to be resolved is:

$$\frac{0{\cdot}61\lambda}{n \sin i}$$

λ is the wave length of the light used, where n is the refractive index and i the semi-angle subtended at the object by the edges of the objective. The quantity $n \sin i$ is called the numerical aperture (N.A.). ↑ MICROSCOPE

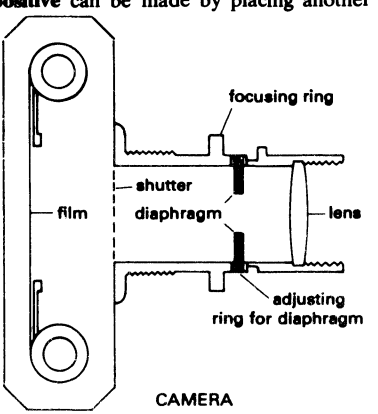


OIL-IMMERSION OBJECTIVE

ND082 oil-immersion objective (*n.*) A type of objective with a number of lenses, the outermost of which (nearest the object) is a hemisphere. The plane side of this dips into cedarwood oil which has the same refractive index as the glass. The object is covered with the oil. Illumination of the object is achieved by a condenser lens which concentrates light on the object. The condenser must supply a beam of as wide an angle as possible. This objective has a high resolving power. The device increases the resolving power without increasing aberration. ↑ MICROSCOPE

ND083 camera (*n.*) An optical instrument which consists of a rectangular box with a converging (+ lens) in one end which allows an image of an object to be formed on the opposite end. A light sensitive film can be placed at the image end. This allows the image to be captured. The diaphragm allows depth of focus to be obtained. ↓ PHOTOGRAPH · SPECTACLES

ND084 photograph (*n.*) A reproduction on special paper of the image of an object obtained with a camera. The light-sensitive paper, the film, is covered with an emulsion containing silver bromide and silver iodide. These compounds decompose in light to give a deposit of silver. The unchanged bromide and iodide can be dissolved off. This leaves a **negative.** The dark places represent the light places on the object. A **positive** can be made by placing another

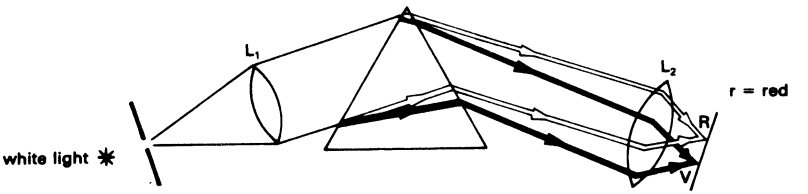


CAMERA

sensitive paper under the negative and by controlling the intensity and duration of light to which it is exposed. Radiation other than visible light can affect the light sensitive materials, *e.g.* X-rays. —***photograph, photography*** (*n.*) ***photograph*** (*v.*) ***photographic*** (*adj.*) ↑ CAMERA

ND085 spectacles (*n.pl.*) A pair of lenses mounted in a light frame which can rest on a person's nose. The lenses provide the necessary correction to any defect of vision. ↑ CAMERA

ND086 dispersion (*n.*) The angular separation of the constituents of a parallel beam of radiation. The constituents are waves of different wave length. Separation of the different wavelengths in a given medium occurs because the waves of different wavelength are travelling at different velocities in that medium. Dispersion may be effected either by refraction with a prism of suitable material or by diffraction with a diffraction grating. —DISPERSE (*v.*) DISPERSED, ***dispersive*** (*adj.*) ↓ COLOUR · SPECTRUM · SPECTROMETER



DISPERSION

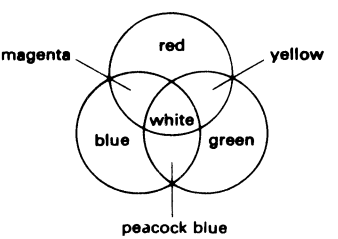
ND087 colour (*n.*) A sensation arising from the operation of the sense of sight, using the eye as an optical instrument. The interpretation of the sensation by the mind results in our awareness of colour. The eye reacts differently to different wavelengths or mixtures of wavelengths. The colour of objects arises because certain wavelengths of white light are reflected from the surface of the object while other wavelengths are absorbed. For liquids, gases, crystalline solids, and amorphous solids there exists a possibility of being colourless or coloured, *e.g.* oxygen is colourless, chlorine is coloured. In general speech most objects are either white, black, or coloured. In scientific contexts colour implies those sensations produced by the separate wavelengths. ↓ LIGHT FILTER · PRIMARY COLOURS · SECONDARY COLOUR · COMPLEMENTARY COLOURS · COLOUR MIXING · SUBTRACTIVE COLOURS · COMPOUND YELLOW · LUMINOSITY ↑ DISPERSION

ND088 light filter (*n.*) A sheet of transparent coloured material which allows the passage of certain colours but absorbs others. The filters are usually sheets of gelatine coloured with an appropriate dye. Coloured glass may also be used. Filters may also be made which absorb infrared and ultraviolet radiation. ↑ COLOUR

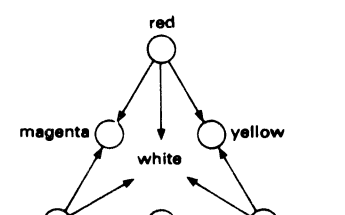
ND089 primary colours (*n.pl.*) A set of colours from which other colours may be made but which themselves cannot be made from any two other colours. For additive colour mixing, *i.e.* coloured lights, the primary colours are magenta, green, and cyan. For subtractive colour mixing, *i.e.* coloured pigments or paints, the primary colours are magenta, yellow, and cyan. ↑ COLOUR

ND090 secondary colour (*n.*) A colour produced by mixing two primary colours. ↑ COLOUR

ND091 complementary colours (*n.pl.*) Two colours that produce white light when mixed by addition. Examples are red and cyan, blue and yellow, and green and magenta. ↑ COLOUR

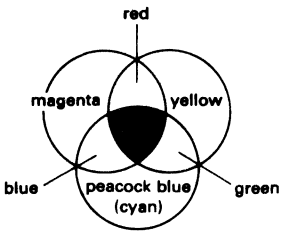


addition of colours

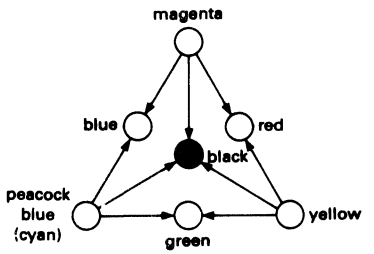


colour triangle

COLOUR MIXING (addition)



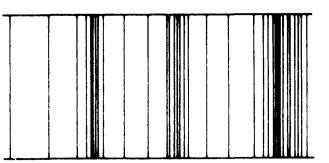
subtraction of colours



colour triangle

COLOUR MIXING (subtraction)

ND092 colour mixing (*n.*) This process may be either mixing coloured pigments or mixing coloured lights.
Mixing coloured pigments is a process of mixing by subtraction (subtractive mixing). It is achieved by mixing paints or dyes and superposition of colour filters. Two colour filters will only transmit the colours which are common to the spectrum of each. Similarly two pigments mixed only reflect the colours common to the spectrum of each.
Mixing coloured lights is a process of mixing by addition (additive mixing), *e.g. a* mixing red, green, and blue gives a white patch on a screen; *b* red and green light together produce yellow light.
It is impossible to obtain a white pigment by mixing coloured pigments. It is impossible to obtain black by mixing coloured light. ↑ COLOUR
ND093 subtractive colours (*n.*) Colours which result from subtracting (by using a filter) a colour from white light, *e.g.* if the red is subtracted from white light the resulting colour is called 'minus red'. ↑ COLOUR
ND094 compound yellow (*n.*) Most yellow filters allow the passage of some green and some red. This yellow light cannot be distinguished by the eye from the pure yellow. The other yellow light is called compound yellow. It is the yellow light reflected by the petals of most yellow flowers. ↑ COLOUR
ND095 spectrum (*n., pl.* **spectra**) A display of colours obtained when white light is dispersed by a prism or by a diffraction grating. Spectra may be emission spectra or absorption spectra. They may also be continuous, line, or band spectra. ↓ VISIBLE SPECTRUM · EMISSION SPECTRUM · ABSORPTION SPECTRUM · CONTINUOUS SPECTRUM[1] · LINE SPECTRUM[1] · BAND SPECTRUM · INFRA-RED RADIATION · ULTRA-VIOLET RADIATION ↑ DISPERSION
ND096 visible spectrum (*n.*) When white light is passed through a prism or diffraction grating a continuous spectrum is formed. The centre part of this is visible from the red end to the blue end. Beyond the red end is a continuous spectrum not visible to the eye but recordable on suitable film. This is called the infra-red. Similarly there is a continuous spectrum beyond the violet which is not visible to the eye but can be recorded on a suitable film. This is called the ultra-violet. Further regions beyond both of these are described under electromagnetic spectrum. ↑ SPECTRUM
ND097 emission spectrum (*n.*) A spectrum produced by a body emitting energy of frequencies in the visible range. Incandescent solids give emission spectra. ↑ SPECTRUM
ND098 absorption spectrum (*n.*) A beam of light from a high temperature emitting source passes through an absorbing medium at a lower temperature. The spectrum shows dark lines or dark regions where particular frequencies have been absorbed by the medium at the lower temperature. An absorbing medium usually absorbs those frequencies which it would emit at a sufficiently high temperature. ↑ SPECTRUM
ND099 continuous spectrum[1] (*n.*) A continuous emission spectrum is one in which the colours change continuously from red, through orange, yellow, green, blue, indigo to violet in the visible range. The same continuity may be found in an absorption spectrum. Solids and liquids usually show broad continuous absorption spectra when heated strongly. ↑ SPECTRUM



LINE SPECTRUM

ND100 line spectrum[1] (*n.*) A line spectrum is one formed when radiation from an incandescent gas is passed through a slit and then dispersed. The lines are produced by energy changes when electrons pass from high energy quantum levels to low energy quantum levels. The electrons are excited from low to high levels by the input of energy into the gas – usually in a discharge tube under a high voltage. ↑ SPECTRUM

ND101 band spectrum (*n.*) In a molecular spectrum a series of fairly broad bands is formed. These bands are sharp at one edge but dying away on the other. They arise from the complex energy changes possible in a molecule. Under high resolution the band is shown to be made up of many lines sharper and closer together at the head of the band but more diffuse away from the head of the band. ↑ SPECTRUM

ND102 infra-red radiation (*n.*) The spectra from sources (heat sources) emitting infra-red radiation are obtained with dispersive methods which do not cause absorption of certain wavelengths, *e.g.* a glass prism absorbs the long wave infra-red but rock salt does not. Infra-red radiation is heat radiation and is recognized by its effect upon the body surface as distinct from visible radiation recognized by the eye. Infra-red radiation arises mainly from molecular movements — rotation, vibration, and bond distortion. ↑ SPECTRUM

ND103 ultra-violet radiation (*n.*) The continuous spectrum beyond the violet end of the visible spectrum. Quartz is used as a dispersive medium as considerable absorption takes place with glass. The radiation has a pronounced effect on living tissue. Ultra-violet radiation has a chemical effect. Silver chloride in sunlight is decomposed by the ultra-violet radiation in the sunlight. The reaction between hydrogen and chlorine is activated by ultra-violet radiation. Ultra-violet radiation arises from electron excitation and transition between energy levels. ↑ SPECTRUM

ND104 luminosity (*n.*) Brightness associated with white or coloured light. The eye varies in sensitivity to brightness across the spectrum; therefore certain colours have greater luminosity than others. ↓ HUE · SHADE · TINT · SATURATION · WHITE LIGHT

ND105 hue (*n.*) This is a subjective quality of a colour. Black, white, and grey, are without hue. They are said to be **achromatic.** Hue is the attribute by which a colour is red, blue, green, etc. Some human eyes can distinguish 130 different hues. Such colours are chromatic. ↑ LUMINOSITY

ND106 shade (*n.*) A shade of a colour is produced when a hue is mixed with some black, *e.g.* a dark shade of green. —***shade*** (*v.*) ↑ LUMINOSITY

ND107 tint (*n.*) A tint is produced when a colour (hue) is mixed with or contains some white. ↑ LUMINOSITY

ND108 saturation (*n.*) The quality of a colour which depends upon the relative proportions of chromatic and achromatic colours. Achromatic colours have zero saturation. Colours which have 100% saturation will be pure colours or chromatic colours (hues). ↑ LUMINOSITY

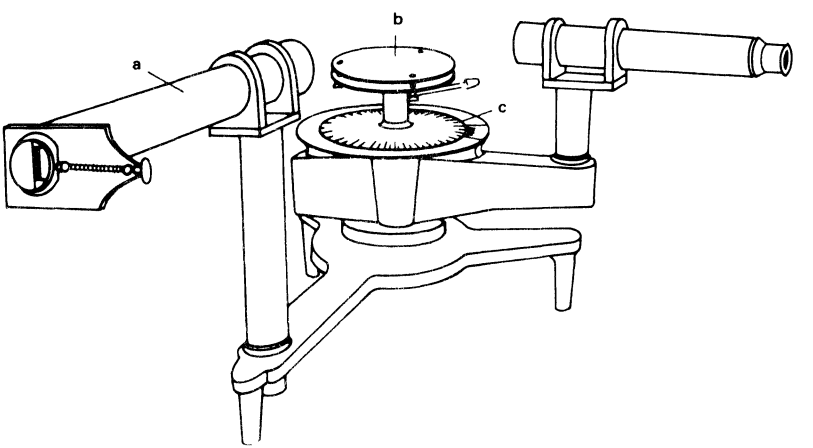
ND109 white light (*n.*) The main radiation which comes from the sun. It forms no image on a white screen but a bright white image on a black screen. When passed through a dispersive medium it is dispersed into an array of colours known as the spectrum. A surface is described as white if it reflects all the constituent wavelengths of white light incident upon it at one time. ↑ LUMINOSITY

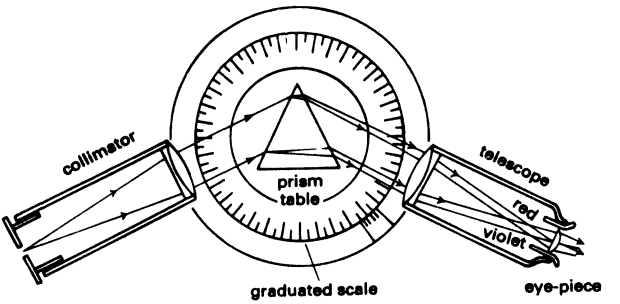
ND110 dispersive medium (*n.*) A material which transmits waves with velocities which vary with the wavelength, *e.g.* glass is a dispersive medium. ↓ DISPERSIVE POWER ↑ SPECTRUM · COLOUR · DISPERSION

ND111 dispersive power (*n.*) Different materials show different amounts of dispersion for light which is not monochromatic. This property is a property of the medium and is called the *dispersive power.* It is defined with reference to three standard wavelengths. They are the C and F lines of hydrogen and the D line of sodium. The symbol for dispersive power is ω:

$$\omega = \frac{n_F - n_C}{n_D - 1}$$

n is the refractive index for the medium for the wavelength indicated. The value of dispersive power is usually of the order of 2×10^{-2} to 5×10^{-2}. ↑ DISPERSIVE MEDIUM





SPECTROMETER

ND112 spectrometer (*n.*) An instrument which allows accurate measurement of refractive indices (indexes) to be made using any wavelength in the visible band and, with suitable recording devices, non-visible bands. Dispersion and spectra can be examined quantitatively. Wavelengths can be measured after suitable calibration of the instrument. It consists of, **a** a collimator; **b** a centred table graduated on its rim; **c** an annulus with vernier coaxial with the table and carrying a telescope. Dispersion is effected by prisms of various materials suitable for the purpose or by a diffraction grating. ↓ COLLIMATOR · SPECTROSCOPE · DIRECT VISION SPECTROSCOPE ↑ DISPERSION

ND113 collimator (*n.*) An instrument for virtual production of an object at infinity. In the spectroscope this amounts to producing a parallel beam which virtually arises at infinity. In a spectrometer it must be on the same optical axis as the telescope, in the zero position. —***collimation*** (*n.*) ↑ SPECTROMETER

ND114 spectroscope (*n.*) An instrument for the examination of spectra. Since atoms of elements in the vapour state may be excited so that there is emission of light of wavelengths depending upon the electron energy levels in the atom, this instrument has important analytical uses. It is essentially similar to a spectrometer in its optical arrangement. When spectrometers are made for special purposes they are often called spectroscopes, *e.g.* the infra-red spectroscope. —***spectroscopy*** (*n.*) ***spectroscopic*** (*adj.*) ↑ SPECTROMETER

ND115 direct vision spectroscope (*n.*) This is a form of spectroscope which produces dispersion without deviation of the yellow light. This is obtained by using a special prism. A portable version can be made. If calibrated for wavelength the instrument can be used for quick determination of constituent elements. ↑ SPECTROMETER

ND116 naked (*adj.*) (Of the eye) unaided by such instruments as telescopes, magnifying glasses, microscopes. An eye normalized by spectacles is still a naked eye, *e.g.* the moons of Jupiter are not visible to the naked eye. ↑ SPECTRUM · COLOUR · DISPERSION

Radiation

NE001 electric spark (*n.*) A discharge of electric current through a gas accompanied by sound and a line of light. ↓ SPARK DISCHARGE · DISCHARGE IN GASES · POSITIVE COLUMN · DISCHARGE TUBE · POSITIVE RAYS · SPARK · CATHODE RAYS · X-RAYS → WAVE

NE002 spark discharge (*n.*) A discharge between electrodes, which takes place in a gas, during which an electric current passes between the electrodes, accompanied by light and sound. The discharge is discontinuous, each spark being seen as a line of light. ↓ SPARKING POTENTIAL · PASCHEN'S LAW · ELECTRIC ARC · ARCING ↑ ELECTRIC SPARK

NE003 sparking potential (*n.*) The minimum potential difference between two conductors which is sufficient to cause an electric spark to pass across the gap between the conductors. ↑ SPARK DISCHARGE

NE004 Paschen's law (*n.*) The law that the sparking potential for a pair of parallel electrodes depends only on the pressure of the gas between the electrodes and the distance between the electrodes. The p.d. is a function of the product of the gas pressure and the separation distance. ↑ SPARK DISCHARGE

NE005 electric arc (*n.*) A luminous continual discharge, accompanied by emission of sound and by a high temperature (usually over 3000°C) which is produced when an electric current flows in the gap between two electrodes. The current is carried by the vapour of the electrode □ *an arc is struck between two electrodes* ↑ SPARK DISCHARGE

NE006 arcing (*n.*) A continuous production of electric arcs between two electrodes or between two contact points in a circuit. A capacitor is usually connected in parallel with the contact points to prevent arcing, as the heat developed can damage the points. ↑ SPARK DISCHARGE

NE007 discharge in gases (*n.*) The passage of an electric current through a gas between electrodes. Electrons and ions are accelerated towards the electrodes by their potential; the transfer of charge forms the electric current. Collisions between electrons and gas molecules produce ions. In discharge tubes, recombination of ions gives rise to luminous glows. ↓ BRUSH DISCHARGE · GLOW DISCHARGE ↑ ELECTRIC SPARK

NE008 brush discharge (*n.*) A violet glow appearing on electrodes in a discharge tube as the pressure in the tube is reduced; it disappears when a spark discharge appears; the latter is replaced by a positive column. ↑ DISCHARGE IN GASES

NE009 glow discharge (*n.*) A silent, steady, luminous discharge between electrodes in a discharge tube. The colour of the discharge depends upon the gas in the discharge tube. A glow discharge takes place at a low pressure, between pressures of 10 and 1 mm of mercury. ↑ DISCHARGE IN GASES

NE010 positive column (*n.*) In a discharge tube, the luminous glow extending from the anode towards the cathode; it fills the tube at a pressure of about 5 mm of mercury. ↓ FARADAY DARK SPACE · NEGATIVE GLOW · CROOKES DARK SPACE · CATHODE GLOW ↑ ELECTRIC SPARK

NE011 Faraday dark space (*n.*) The dark space in a discharge tube between the negative glow and the positive column. ↑ POSITIVE COLUMN

NE012 negative glow (*n.*) A luminous glow between the Crookes dark space and the Faraday dark space. ↑ POSITIVE COLUMN

NE013 Crookes dark space (*n.*) A dark space in front of the cathode glow. As gas pressure in the discharge tube is further reduced, the Crookes dark space eventually fills the whole tube. ↑ POSITIVE COLUMN

NE014 cathode glow (*n.*) A luminous glow just in front of the cathode. ↑ POSITIVE COLUMN

NE015 discharge tube (*n.*) A general term describing an instrument, usually a glass vessel, in which an electric current passes from anode to cathode in a vacuum or in a gas at a low pressure. ↓ DISCHARGE LAMP · MERCURY VAPOUR LAMP · SODIUM VAPOUR LAMP · NEON LAMP · STRIKING POTENTIAL · EXTINCTION POTENTIAL · NEON TUBE · NEON SIGN · ARC LAMP ↑ ELECTRIC SPARK

NE016 discharge lamp (*n.*) A discharge tube, made of glass, containing a gas at low pressure; when an electric current passes, the gas glows. Gases have characteristic colours when they emit light during glowing. ↑ DISCHARGE TUBE

NE017 mercury vapour lamp (*n.*) A discharge lamp filled with mercury vapour; it gives out a greenish-white glow; used for street lighting. ↑ DISCHARGE TUBE

NE018 sodium vapour lamp (*n.*) A discharge lamp filled with sodium vapour; it gives out a golden-yellow glow; used for street lighting. ↑ DISCHARGE TUBE

NE019 neon lamp (*n.*) A lamp filled with neon gas at low pressure. It requires a p.d. of about 180 volts (striking potential) before a glow is formed in the lamp. The voltage across the lamp then drops to a lower value. To extinguish the lamp, the applied p.d. must be lowered below this value (extinction potential). ↑ DISCHARGE TUBE

NE020 striking potential (*n.*) The potential difference needed to cause a discharge lamp to begin to produce a glow discharge. The glow discharge can be maintained at any potential between the striking and the extinction potentials. It is also the potential difference required to strike an arc. ↑ DISCHARGE TUBE

NE021 extinction potential (*n.*) The potential difference below which the glow discharge of a discharge lamp ceases. ↑ DISCHARGE TUBE

NE022 neon tube (*n.*) Originally a discharge lamp filled with neon gas; it produces an intense orange-red colour on glowing when passing an electric current. The term is now used to describe any long tube filled with other gases and used to make advertising signs (such as seen outside shops, hotels, etc.); such a tube is also called a ***neon sign.*** ↑ DISCHARGE TUBE

NE023 neon sign (*n.*) Alternative term for NEON TUBE, when used for advertising purposes. ↑ DISCHARGE TUBE

NE024 arc lamp (*n.*) A device for producing a very bright white light by an electric arc formed between two carbon electrodes. A mechanism is provided to strike the arc between the electrodes and another mechanism is provided to push the electrodes closer together as they are vaporized away by the electric arc. ↑ DISCHARGE TUBE

NE025 positive rays (*n.pl.*) A discharge tube with a perforated cathode is used to produce positive rays. When the gas pressure is reduced to 10^{-2} mm of mercury, luminous streamers, the positive rays, are formed behind the cathode, on the opposite side from the anode. The positive rays are deflected by electric and magnetic fields and their properties show them to be beams of positively charged ions. ↓ CANAL RAYS ↑ ELECTRIC SPARK

NE026 canal rays (*n.pl.*) Alternative term for POSITIVE RAYS (↑).

NE027 spark (*v.i.*) To produce a succession of electric sparks —***sparking*** (*adj.*) ↓ GLOW[2] ↑ ELECTRIC SPARK

NE028 glow[2] (*v.i.*) To emit light without a flame, usually accompanied by the emission of heat, but not accompanied by sound □ *a hot piece of carbon glows brightly* —***glow*** (*n.*) ***glowing*** (*adj.*) ↑ SPARK

NE029 cathode rays (*n.pl.*) A term formerly used to describe the radiation emitted by a

cathode in a discharge tube under suitable conditions. The rays can be deflected by electric and magnetic fields, and their behaviour shows the rays to consist of a beam of negatively charged particles, in fact a beam of electrons. The rays carry energy; on striking the end of the discharge tube, they are transformed into heat energy and a very small proportion is transformed into X-rays and light. ↓ CATHODE-RAY TUBE · ELECTRON GUN · TELEVISION · ACCELERATOR[2] ↑ ELECTRIC SPARK

NE030 cathode-ray tube (*n.*) When a discharge tube operates at a suitably low pressure (less than 0·01 mm of mercury) the Crookes dark space occupies the whole of the tube and a green fluorescence (with soda glass) is observed at the end of the tube, directly opposite the cathode. The fluorescence is caused by the bombardment of the glass by electrons; formerly the beam of electrons was called cathode rays. Tubes are used with cold cathodes or hot cathodes. ↓ COLD CATHODE · HOT CATHODE · CATHODE-RAY OSCILLOSCOPE · CRT · CRO ↑ CATHODE RAYS

NE031 cold cathode (*n.*) A metal cathode in a cathode-ray tube. Very high potentials are needed to obtain discharge effects in gases. ↑ CATHODE-RAY TUBE

NE032 hot cathode (*n.*) A hot filament used as a cathode in a discharge tube. The filament, made from fine wire, is heated by a battery of low voltage. Electrons are emitted from the filament by the thermionic effect and discharge effects in gases are obtained at potentials much lower than with a cold cathode. ↑ CATHODE-RAY TUBE

NE033 cathode-ray oscilloscope (*n.*) An instrument based on a cathode-ray tube. Electrons from an electron gun are focused by an electron lens to form a spot on a fluorescent screen. The beam passes through two pairs of plates, to which electric potentials are applied; one pair of plates deflects the beam horizontally, the other pair deflects the beam vertically. The instrument provides a visual display of one or more rapidly varying electrical quantities, such as potential differences, waveforms of alternating current, and phase differences of alternating current. ↑ CATHODE-RAY TUBE

NE034 CRT (*abbr.*) Abbreviation for CATHODE-RAY TUBE. ↑ CATHODE-RAY TUBE

NE035 CRO (*abbr.*) Abbreviation for CATHODE-RAY OSCILLOSCOPE. ↑ CATHODE-RAY TUBE

NE036 electron gun (*n.*) Electrons from a hot cathode are concentrated into a beam by a Wehnelt cylinder and attracted by an anode at a high positive potential. The electron beam passes through a hole in the anode and emerges as a narrow beam of electrons. An electron lens is frequently used in conjunction with an electron gun to focus the beam of electrons. ↓ WEHNELT CYLINDER · ELECTRON LENS · ELECTRON DIFFRACTION · ELECTRON MICROSCOPE ↑ CATHODE RAYS

NE037 Wehnelt cylinder (*n.*) A metal cylinder ending in wire mesh, used round the cathode in an electron gun; it is kept at a negative potential with respect to the cathode and concentrates electrons from the cathode into a beam. ↑ ELECTRON GUN

NE038 electron lens (*n.*) Electric fields produced by parallel-plate capacitors, or magnetic fields produced by parallel electromagnets, used to focus a beam of electrons. The beam of electrons passes between the plates of the capacitor or between the electromagnets, and can be brought to a focus at infinity (for a parallel beam) or at a point nearer to the electron lens. ↑ ELECTRON GUN

NE039 electron diffraction (*n.*) When a beam of electrons is passed through a thin piece, or a thin film, of a material, diffraction of the beam occurs in a manner similar to the diffraction of light or of X-rays. This phenomenon is the principal evidence for the dual nature of elementary particles. Crystal structure is frequently investigated through electron diffraction by crystals and by metal foils. ↑ ELECTRON GUN → DE BROGLIE'S EQUATION

NE040 electron microscope (*n.*) A parallel beam of electrons from an electron gun is passed through a very thin piece or film of material. Differential scattering of the electron beam takes place, and an image of the material is carried forward in the electron beam. An electron lens is used to focus the electron beam on a fluorescent screen, where a magnified image is formed. The image is observed or photographed. The resolving power of the electron microscope is very much greater than that of a light microscope. ↑ ELECTRON GUN

NE041 television (*n.*) A system for transmitting visible moving images by radio waves (in broadcast television) or by line (in closed television). A camera records the moving objects and divides the field of view into a number of elements. The light from each element is transformed into an electrical impulse. The succession of electrical impulses are transformed by the receiver into a visual image. The radio wave is modulated to send sound and vision signals and also a synchronizing signal to ensure the correct position of the image on the screen. ↓ TELEVISION RECEIVER · SCANNING · MOSAIC[4] · ELEMENT[2] ↑ CATHODE RAYS

NE042 television receiver (*n.*) The essential part of the receiver is a cathode ray tube, with coils of wire forming electromagnets which deflect the electron beam onto a fluorescent screen. The picture seen on the screen is composed of picture elements with 400 elements in a line and either 405 or 625 lines on the screen. Each element can vary between black and white with all shades between and the persistence of vision combines these elements into a black and white picture. ↑ TELEVISION

NE043 scanning (*n.*) The motion of a beam of electrons from side to side of the fluorescent screen of a cathode ray tube. The side

to side motion may be coupled with a vertical motion. Scanning occurs in cathode-ray oscilloscopes and in television receivers; during scanning electrical impulses are changed to light impulses. The reverse process of changing incident light on a screen (as in a television camera) to a series of electrical impulses is also called scanning. —SCAN (*v.*) ↑ TELEVISION

NE044 mosaic[4] (*n.*) (In a television camera) a device for splitting an optical image into elements which can subsequently be scanned; it usually consists of a sheet of mica covered on one side with granules of photo-emissive material, each corresponding to one element and insulated mutually from all other particles. The reverse side of the mica sheet is covered with a conducting coat, coupled capacitatively with the photo-emissive granules. The conducting coat is called the signal plate; it is the output electrode. An electron beam scans the signal plate. When light is focused on the granules, they emit electrons and become positively charged. The light image is transformed to an electric-charge image. The electron beam, from a cathode-ray tube, discharges the particles when it strikes the signal plate and a small electric current flows from the signal plate. ↑ TELEVISION

NE045 element[2] (*n.*) A small part of an object, which is composed of many similar small parts. ↑ TELEVISION

NE046 accelerator[2] (*n.*) An apparatus, or part of a machine, for imparting a high kinetic energy to charged particles, such as electrons, protons, or alpha-particles, by accelerating them with magnetic fields and high voltage electric fields. ↓ HIGH-VOLTAGE ACCELERATOR · BETATRON · CYCLOTRON · SYNCHROCYCLOTRON · FM CYCLOTRON · SYNCHROTRON ↑ CATHODE RAYS

NE047 high-voltage accelerator (*n.*) Alternative term, and a fuller description of an ACCELERATOR. ↑ ACCELERATOR[2] (↑).

NE048 betatron (*n.*) An accelerator consisting of a discharge tube in the shape of a torus placed between the poles of an electromagnet. A rapidly changing magnetic flux produces a rapidly changing electric field in the discharge tube. A continuous beam of electrons is accelerated to high speeds by this electric field, with the electrons moving in stable circular orbits. The high energy electron beam, thus produced, finally collides with an anti-cathode, producing X-rays of great penetrating power, or gamma rays. ↑ ACCELERATOR[2]

NE049 cyclotron (*n.*) A machine consisting of two semi-circular electrodes contained in an evacuated box mounted between the poles of an electromagnet. An ion source for protons or deuterons is placed between the electrodes at the centre. A radio frequency oscillator provides a high frequency electric field between the electrodes, and the field accelerates the particles from one electrode to the other. The magnetic field makes the particles travel in a circular orbit, and the alternating electric field in combination with the magnetic field causes the particles to travel along a spiral path from the centre to the circumference of the electrode. A beam of high energy particles emerges at the circumference with energies up to $3{\cdot}2 \times 10^{-12}$ J (20 MeV). ↑ ACCELERATOR[2]

NE050 synchrocyclotron (*n.*) A type of cyclotron in which the frequency of the electric field is continually varied from a high frequency, at the moment of injection of the particle, to a lower frequency at the moment of ejection. This produces a much higher energy particle. ↑ ACCELERATOR[2]

NE051 FM cyclotron (*n.*) Alternative term for SYNCHROCYCLOTRON. ↑ ACCELERATOR[2]

NE052 synchrotron (*n.*) A machine consisting of a large annular ring (a **torus**) into which atomic or sub-atomic particles are injected tangentially from a subsidiary accelerator. A magnetic field causes the electrons to travel in a circular path round the torus. A hollow cylindrical electrode is placed at one point of the torus, and a high frequency generator provides an electric field of constant frequency to accelerate the particles. The magnetic field is increased to maintain the path of the particles in the torus. This machine produces particles with the highest energy. ↑ ACCELERATOR[2]

NE053 X-rays (*n.pl.*) Electromagnetic waves of high frequency; the upper limit is considered to be 6×10^{19} Hz, corresponding to a wavelength of 5×10^{-12} m; the lower limit corresponds to the upper limit of ultra-violet radiation, *i.e.* frequencies of the order of 10^{17} Hz (a wavelength of 3×10^{-9} m). X-rays are produced by X-ray tubes when a stream of electrons strikes a metallic target. The properties of X-rays include: ***a*** passing through many substances opaque to visible light; ***b*** ionization of air through which they pass; ***c*** diffraction by crystal lattices; ***d*** the ability to affect a photographic plate (as do electromagnetic waves in the visible and ultraviolet ranges). ↓ X-RAY TUBE · X-RAY SPECTROMETER · RADIOGRAPHY · RADIOTRANSPARENT ↑ ELECTRIC SPARK

NE054 X-ray tube (*n.*) An instrument for producing X-rays. It consists of an evacuated tube with a cathode and a massive anode or anti-cathode containing a target. The cathode is usually a heated tungsten filament emitting electrons which are focused (as in an electron gun) on the target. The anode is usually made of copper, has external cooling fins and may be water-cooled. The target is usually a small piece of tungsten mounted in the anode and inclined at an angle so that X-rays are emitted at right angles to the electron stream. They leave the tube through a thin window. The target emits X-rays when bombarded by a stream of electrons: the spectrum of the X-rays depends on the voltage between the anode and cathode and the nature of the target. ↓ TARGET[2] · ANTICATHODE · RÖNTGEN

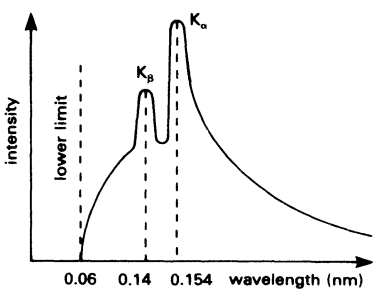
RAYS ↑ X-RAYS

NE055 target[2] (*n.*) The part of the anode struck by the electrons in an X-ray tube. ↑ X-RAY TUBE

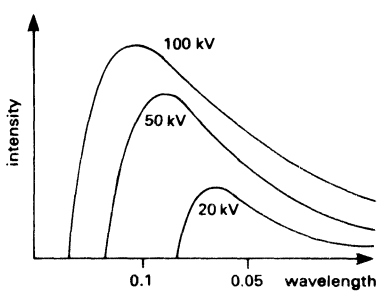
NE056 anticathode (*n.*) (In X-ray tubes) a metal plate opposite the cathode; electrons (cathode rays) from the cathode strike the anticathode and produce X-rays. The anticathode is not necessarily the anode; a separate anode is generally used and the anticathode contains the target. ↑ X-RAY TUBE

NE057 Röntgen rays (*n.pl.*) Alternative term for X-RAYS. ↑ X-RAY TUBE

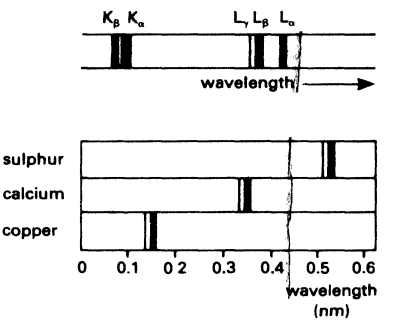
NE058 X-ray spectrometer (*n.*) An instrument for determining the wavelength of X-rays. An X-ray tube produces X-rays; two slits in front of the tube form a narrow beam of radiation. The X-ray beam glances off a crystal (usually rock salt) and the weakly reflected beam passes through a slit into an ionization chamber. The intensity of the X-rays is measured by the ionization chamber; the wavelength is determined from Bragg's law. ↓ X-RAY SPECTRUM · CONTINUOUS SPECTRUM[2] · LINE SPECTRUM[2] · K-LINE ↑ X-RAYS → BRAGG'S LAW



(a) X-RAY SPECTRUM FOR COPPER



(b) BACKGROUND SPECTRA



(c) X-RAY LINE SPECTRA

NE059 X-ray spectrum (*n.*) The variation of intensity of X-rays with wavelength forms an X-ray spectrum. A typical spectrum is shown in the figure; it consists of a continuous spectrum with two peaks. The position of the peaks depends on the material of the target; the spectrum shown is for copper. ↑ X-RAY SPECTROMETER

NE060 continuous spectrum[2] (*n.*) The distribution of intensity in a continuous spectrum is independent of the nature of the target. There is a sharply defined lower limit of wavelength which depends on the voltage difference between anode and cathode; the higher the voltage the lower the limit of wavelength. See figure for shape of distribution curve. ↑ X-RAY SPECTROMETER

NE061 line spectrum[2] (*n.*) Each element produces a characteristic line spectrum. The peaks of maximum intensity occur at definite wavelengths for each element and are plotted as lines in a spectrum. A typical spectrum for an element of medium relative atomic mass is shown in the figure. It consists of two K-lines (K_α and K_β) of different intensities and three L-lines; usually only the K-lines are detected. The wavelength of the K-lines decreases with increasing relative atomic mass of the elements. ↑ X-RAY SPECTROMETER

NE062 K-line (*n.*) A continuous spectrum comes from the slowing down of electrons; a line spectrum comes from the emission of radiation by excited ions, resulting from the removal of an inner electron from an atom. A K-line is produced by an outer electron falling back into a K-orbital to replace an ejected electron. An L-line is similarly produced when an outer electron falls back into an L-orbital. See X-RAY SPECTRUM (↑). ↑ X-RAY SPECTROMETER → QUANTUM NUMBER[2]

NE063 radiography (*n.*) The formation of images produced by X-rays or gamma rays on a fluorescent screen or on a photographic plate. ↓ RADIOGRAPH · LAUE X-RAY PHOTOGRAPH · QUALITY[2] ↑ X-RAYS

NE064 radiograph (*n.*) A photographic record of an image formed by X-rays after passing through an object. The absorption

of X-rays depends upon the density and the relative atomic mass of the material. Bones are more opaque to X-rays than flesh, hence they appear as a light image on a negative photographic plate. ↑ RADIOGRAPHY

NE065 Laue X-ray photograph (*n.*) A narrow beam of X-rays when passed through a crystal is diffracted by the crystal lattice. A central spot, caused by the undiffracted beam, is surrounded by a pattern of spots, arising from diffraction. The crystal structure can be determined by the measurements of the pattern of those spots. ↑ RADIOGRAPHY

NE066 quality[2] (*n.*) A term formerly used to describe the penetrating power of X-rays. The quality of an X-ray is determined by its wavelength. X-rays produced by a potential difference of 20 kV or less were called **soft** X-rays and have a low penetration. With a potential difference greater than 20 kV, **hard** X-rays are produced, which have a greater penetrating power. Soft X-rays are used in medical X-ray photography; hard X-rays are used in the treatment of malignant growths. Soft X-rays have a wavelength longer than 0·06 nm; hard X-rays have a wavelength shorter than 0·06 nm. ↑ RADIOGRAPHY

NE067 radio transparent (*adj.*) Describes a material which permits radiation, particularly X-rays and gamma rays, to pass with little or no decrease in the intensity. ↓ RADIOLUCENT (Sn) · RADIO OPAQUE (An) ↑ X-RAYS

NE068 radiolucent (*adj.*) Describes a material which allows radiation to pass with some reduction in the intensity, *i.e.* some radiation is absorbed. Flesh is radiolucent; the reduction in intensity is seen in a radiograph, where flesh is distinguished from the background, where there is no absorption. ↓ RADIO OPAQUE (An) ↑ RADIO TRANSPARENT (Sn)

NE069 radio opaque (*adj.*) Describes a material which absorbs most or all of a radiation, *e.g.* bones are radio-opaque to X-rays of longer wavelengths. Opaqueness depends on the nature of the material and the wavelength of the radiation. Materials with atoms of high relative atomic mass are stronger in absorption. Radiation of shorter wavelength has a greater penetrating power. ↑ RADIO TRANSPARENT (An) · RADIOLUCENT (An)

Radioactivity

NF001 radioactivity (*n.*) The disposition of some elements to undergo spontaneous disintegration of their nuclei associated with the emission of ionizing particles. These particles may be α-particles, β-particles or γ-radiation. Radioactivity may be natural or artificial. —***radioactive*** (*adj.*) ↓ NATURAL RADIOACTIVITY · RADIOACTIVE TYPE · RADIOACTIVE DISINTEGRATION · DISINTEGRATION SERIES · CLOUD CHAMBER · NUCLEAR REACTION

NF002 natural radioactivity (*n.*) If a nucleus of an isotope of an element is unstable it disintegrates to form more stable products. When this process is spontaneous it is called natural radioactivity. All isotopes of elements with atomic number above 83 show natural radioactivity. ↓ ARTIFICIAL RADIOACTIVITY · INDUCED RADIOACTIVITY · α-PARTICLE · β-PARTICLE · γ-RADIATION

NF003 artificial radioactivity (*n.*) Radioactive isotopes may be prepared by bombarding stable isotopes with particles of high energy, *e.g.* α-particles ($^{4}_{2}\mathrm{He}$), deuterons ($^{2}_{1}\mathrm{H}$), and neutrons ($^{1}_{0}\mathrm{n}$). These isotopes exhibit artificial radioactivity, *e.g.*

$$^{27}_{13}\mathrm{Al} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{30}_{15}\mathrm{P} + {}^{1}_{0}\mathrm{n}$$

Aluminium-27 bombarded with α-particles gives radioactive phosphorus-30 and neutrons

$$^{23}_{11}\mathrm{Na} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{24}_{11}\mathrm{Na}$$

Sodium-23 bombarded by neutrons produces radioactive sodium-24. ↑ NATURAL RADIOACTIVITY

NF004 induced radioactivity (*n.*) Alternative term for ARTIFICIAL RADIOACTIVITY.

NF005 α-particle (*n.*) A helium nucleus, of mass 4·0029 atomic mass units and charge +2 units. α-particles have a penetrating power in air of about 2 cm. When emitted from a nucleus they may have speeds of the order of $1{\cdot}6 \times 10^{4}\ \mathrm{km\ s^{-1}}$. They ionize gases through which they pass and produce scintillations on a fluorescent screen. ↑ NATURAL RADIOACTIVITY

NF006 β-particle (*n.*) A high-energy electron, with a velocity up to 99% of the velocity of light. β-particles penetrate thin metal foil. They ionize gases through which they pass. ↑ NATURAL RADIOACTIVITY → ELECTRON

NF007 γ-radiation (*n.*) Electromagnetic radiation which is emitted during certain radioactive disintegrations. γ-radiation accompanies the emission of α- and β-particles. It has very high penetrating power, *e.g.* 150 mm of lead. The photons travel with the speed of light. They are not deflected by an electric or magnetic field. The wavelength of the γ-radiation is characteristic of the emitting nucleus. ↑ NATURAL RADIOACTIVITY → ELECTROMAGNETIC WAVES

NF008 radioactive type (*n.*) Radioactive processes are classified into four types according to the manner in which change takes place in the nucleus. They are, *a* α-emission; *b* β-emission; *c* positron emission; *d* K- capture. ↓ α-EMISSION · β-emission · POSITRON EMISSION · K-CAPTURE ↑ RADIOACTIVITY

NF009 α-emission (*n.*) A process in which an α-particle ($^4_2$He) is ejected by the nucleus. The resulting nucleus has a mass number four atomic mass units less, *i.e.* 4 neutrons fewer, and an atomic number two less, *i.e.*2 protons fewer, *e.g.*

$$^{232}_{90}\text{Th} \rightarrow {}^{228}_{88}\text{Ra} + {}^{4}_{2}\text{He}.$$

↑ RADIOACTIVE TYPE

NF010 β-emission (*n.*) A process in which a β-particle ($^0_{-1}$e) is emitted by the nucleus. Neutrons change, giving protons and electrons:

$$^1_0\text{n} \rightarrow {}^1_1\text{p} + {}^0_{-1}\text{e}$$

If the proton remains in the nucleus there is an increase of one in the atomic number, *i.e.* a new element is formed. There is no change in mass number.

$$^{32}_{15}\text{P} \rightarrow {}^{32}_{16}\text{S} + {}^0_{-1}\text{e}$$

↑ RADIOACTIVE TYPE

NF011 positron emission (*n.*) A process in which a positron ($^0_1$e) is emitted from the nucleus. There are no positrons in the nucleus but the change

$$^1_1\text{p} \rightarrow {}^1_0\text{n} + {}^0_1\text{e}$$

can take place. A single free proton does not change in this way because the process absorbs much energy:

$$^{18}_{9}\text{F} \rightarrow {}^{18}_{8}\text{O} + {}^0_1\text{e}$$

This type occurs only with artificial isotopes. Note: the usual fluorine nucleus is $^{19}_{9}$F. $^{18}_{9}$F is a radioactive isotope. Atomic number decreases by one. Mass number remains unchanged. ↑ RADIOACTIVE TYPE

NF012 K-capture (*n.*) A process in which a nucleus takes (captures) an electron from the innermost shell, *i.e.* the K-shell, or shell 1, of the electron field. This amounts to changing a proton to a neutron, and so no change in mass number occurs but the atomic number decreases by 1, *e.g.*

$$^7_4\text{Be} + {}^0_{-1}\text{e} \rightarrow {}^7_3\text{B}.$$

↑ RADIOACTIVE TYPE

NF013 radioactive disintegration (*n.*) This is a way of looking at radioactive processes from the point of view of the nucleus rather than of the emitted particles and radiation. It was used of the first such processes in which it appeared that the atom was breaking up, *i.e.* losing its unity. ↓ RATE OF DISINTEGRATION · HALF-LIFE · RADIOACTIVE DECAY CONSTANT · CURIE ↑ RADIOACTIVITY

NF014 radioactive decay (*n.*) Slow decrease with time of radioactivity of a sample. ↑ RADIOACTIVE DISINTEGRATION

NF015 rate of disintegration (*n.*) The rate at which the nuclei in a sample disintegrate or change. It is characteristic of the isotope of which they are nuclei. The rate is proportional to the number of atoms present. It is therefore a first order reaction. This can be shown as:

$$-\frac{dN}{dt} = \lambda N$$

N = number of atoms unchanged, t = time in seconds, λ = the rate constant. The rate of disintegration is expressed as the number of disintegrations in one second (the number of atoms which disintegrate in one second). ↑ RADIOACTIVE DISINTEGRATION

NF016 half-life (*n.*) The time taken for one half of the atoms in a sample to disintegrate or change. It follows that this value is a constant because the reaction is first order. Half-life is therefore an important characteristic of a radioactive element, *e.g.* the half-life for radium-226 is 1620 years, while that of uranium-238 is $4{\cdot}5 \times 10^9$ years, that of polonium-214 is $1{\cdot}5 \times 10^{-4}$ seconds. ↑ RADIOACTIVE DISINTEGRATION

NF017 radioactive decay constant (*n.*) In the expression of the rate of disintegration,

$$-\frac{dN}{dt} = \lambda N$$

the term λ (the rate constant) is called the radioactive decay constant for the element (isotope). For example, the radioactive decay constant for uranium-238 is $4{\cdot}883 \times 10^{-18}$ s^{-1}. ↑ RADIOACTIVE DISINTEGRATION

NF018 radioactive constant (*n.*) Alternative term for RADIOACTIVE DECAY CONSTANT.

NF019 curie (*n.*) A unit of activity of a radioactive specimen. It is that activity which arises from $3{\cdot}7 \times 10^{10}$ disintegrations per second. 1 curie of uranium-238 will be $2{\cdot}996 \times 10^6$ g, *i.e.* this mass of uranium-238 will have an activity of $3{\cdot}7 \times 10^{10}$ disintegrations per second ↑ RADIOACTIVE DISINTEGRATION

NF020 exponential decay (*n.*) A process which decreases following an exponential rate. The term is used especially in the present context of radioactive disintegration. Such disintegrations follow a first order rate:

$$-\frac{dN}{dt} = \lambda N$$

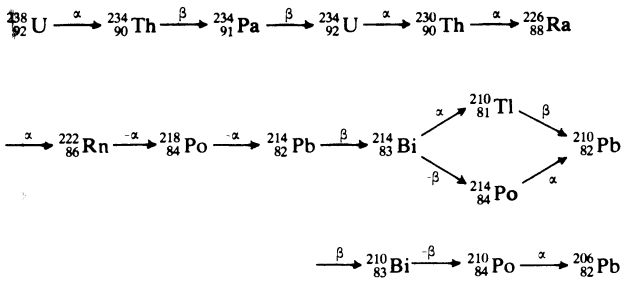
N = number of undecayed atoms.

After integration between limits N_0 and N (N_0 is the value of N at $t = 0$):

$$\frac{N}{N_0} = e^{-\lambda t} \quad (N = N_0 e^{-\lambda t}).$$

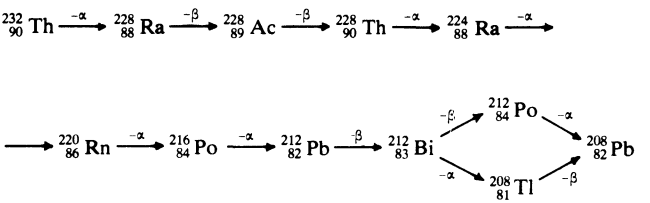
↑ RADIOACTIVE DISINTEGRATION

NF021 disintegration series (*n.*) In natural radioactivity the processes follow three well-established courses and they are named by the element with which they start. The series are, *a* the uranium series; *b* the thorium series; *c* the actinium series. The neptunium series does not occur in nature. ↓ RADIOACTIVE DECAY CHAIN · URANIUM SERIES · THORIUM SERIES · ACTINIUM SERIES · GROUP DISPLACEMENT LAW ↑ RADIOACTIVITY


$^{238}_{92}U \xrightarrow{\alpha} {}^{234}_{90}Th \xrightarrow{\beta} {}^{234}_{91}Pa \xrightarrow{\beta} {}^{234}_{92}U \xrightarrow{\alpha} {}^{230}_{90}Th \xrightarrow{\alpha} {}^{226}_{88}Ra$
$\xrightarrow{\alpha} {}^{222}_{86}Rn \xrightarrow{-\alpha} {}^{218}_{84}Po \xrightarrow{-\alpha} {}^{214}_{82}Pb \xrightarrow{\beta} {}^{214}_{83}Bi$
$\xrightarrow{\alpha} {}^{210}_{81}Tl \xrightarrow{\beta} {}^{210}_{82}Pb$
$\xrightarrow{-\beta} {}^{214}_{84}Po \xrightarrow{\alpha} {}^{210}_{82}Pb$
$\xrightarrow{\beta} {}^{210}_{83}Bi \xrightarrow{-\beta} {}^{210}_{84}Po \xrightarrow{\alpha} {}^{206}_{82}Pb$

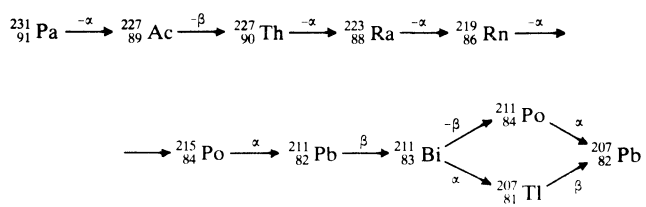
URANIUM SERIES

NF022 uranium series (*n.*) A radioactive series which begins with $^{238}_{92}U$ and passes by 15 steps to $^{206}_{82}Pb$, which is a stable nuclide. ↑ DISINTEGRATION SERIES


$^{232}_{90}Th \xrightarrow{-\alpha} {}^{228}_{88}Ra \xrightarrow{-\beta} {}^{228}_{89}Ac \xrightarrow{-\beta} {}^{228}_{90}Th \xrightarrow{-\alpha} {}^{224}_{88}Ra \xrightarrow{-\alpha}$
$\xrightarrow{} {}^{220}_{86}Rn \xrightarrow{-\alpha} {}^{216}_{84}Po \xrightarrow{-\alpha} {}^{212}_{82}Pb \xrightarrow{-\beta} {}^{212}_{83}Bi$
$\xrightarrow{-\beta} {}^{212}_{84}Po \xrightarrow{-\alpha} {}^{208}_{82}Pb$
$\xrightarrow{-\alpha} {}^{208}_{81}Tl \xrightarrow{-\beta} {}^{208}_{82}Pb$

THORIUM SERIES

NF023 thorium series (*n.*) A radioactive series which begins with $^{232}_{90}Th$ and proceeds by 11 steps to $^{208}_{82}Pb$ (stable nuclide). ↑ DISINTEGRATION SERIES

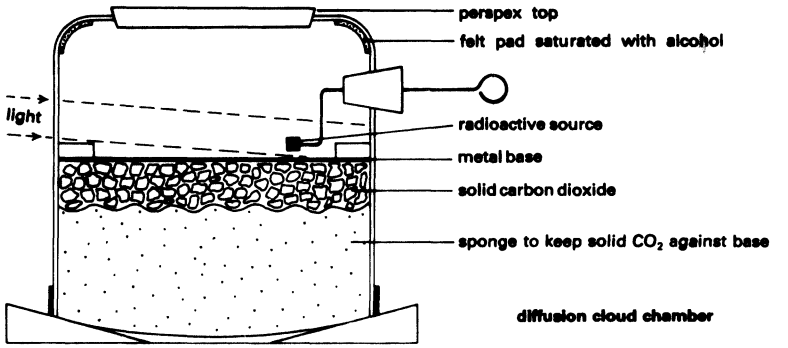

$^{231}_{91}Pa \xrightarrow{-\alpha} {}^{227}_{89}Ac \xrightarrow{-\beta} {}^{227}_{90}Th \xrightarrow{-\alpha} {}^{223}_{88}Ra \xrightarrow{-\alpha} {}^{219}_{86}Rn \xrightarrow{-\alpha}$
$\xrightarrow{} {}^{215}_{84}Po \xrightarrow{\alpha} {}^{211}_{82}Pb \xrightarrow{\beta} {}^{211}_{83}Bi$
$\xrightarrow{-\beta} {}^{211}_{84}Po \xrightarrow{\alpha} {}^{207}_{82}Pb$
$\xrightarrow{\alpha} {}^{207}_{81}Tl \xrightarrow{\beta} {}^{207}_{82}Pb$

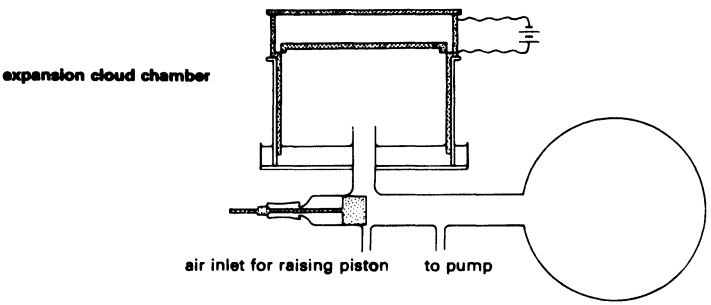
ACTINIUM SERIES

NF024 actinium series (*n.*) A radioactive series which begins with $^{231}_{91}Pa$ (protoactinium) and ends with $^{207}_{82}Pb$ (stable nuclide). ↑ DISINTEGRATION SERIES

NF025 radioactive decay chain (*n.*) Alternative term for DISINTEGRATION SERIES (↑).

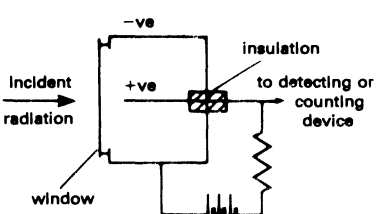
NF026 group displacement law (*n.*) During radioactive changes the loss of an α-particle leads to the formation of an element two places to the left in the periodic table, while loss of a β-particle leads to the formation of an element one place to the right, *e.g.* $^{238}_{92}U$ loses an α-particle and becomes $^{234}_{90}Th$. In the periodic table uranium and thorium are in the inner transition series, the actinides: Th Pa U. The shift from U to Th is a shift of two to the left. $^{234}_{90}Th$ loses a β-particle and becomes $^{234}_{91}Pa$, moving one step to the right. ↑ DISINTEGRATION SERIES





CLOUD CHAMBERS

NF027 cloud chamber (*n.*) The principle of the cloud chamber is that it makes visible the tracks of ionizing particles by passing them through a supersaturated vapour. There are two types. ***a* the expansion cloud chamber** In this arrangement supersaturation is achieved by adiabatic expansion and therefore sudden cooling of an inert gas with a saturated vapour. ***b* the diffusion cloud chamber** Here supersaturation is achieved by diffusion of a vapour from a hot surface to a cold surface through an inert gas. Ions produced by the passage of ionizing particles act as nuclei for the condensation of droplets from the supersaturated vapour. ↓ GEIGER COUNTER · SPINTHARISCOPE · RADIOACTIVE TRACERS



GEIGER COUNTER

NF028 geiger counter (*n.*) A device for detecting ionizing radiations. It consists of a metal tube as negative electrode. The tube is filled with argon at a low pressure. The positive electrode is a wire down the centre of the tube. This is maintained at a high potential, but not so high that it produces discharge. The passage of an ionizing particle, *e.g.* a β-particle or γ-radiation, causes ionization and therefore discharge between the electrodes. This gives a pulse of electric current, which can be counted, recorded, etc. ↑ CLOUD CHAMBER

NF029 spintheriscope (*n.*) A device originally used for rough measurement of the number of α-particles emitted, by counting the scintillations they produce on a phosphorescent zinc sulphide screen. ↑ CLOUD CHAMBER

NF030 scintillation (*n.*) A sparkling or flash, *e.g.* the impact of a photon or an α-particle on a zinc sulphide screen is marked by a scintillation. —***scintillate*** (*v.*) ***scintillating*** (*adj.*) ↑ CLOUD CHAMBER

NF031 radioactive tracers (*n.pl.*) Radioactive isotopes, especially artificial ones, are often used in systems to allow the tracking of the progress of an element. For example, iodine radioactive isotopes are used in medicine to investigate the iodine in the body. ^{32}P, an isotope of phosphorus, is used for tracing the distribution and path of

phosphorus compounds in living organisms. ↑ CLOUD CHAMBER

NF032 nuclear reaction (*n.*) A reaction which involves changes in the nucleus. Nuclear reactions are usually reactions between a nucleus and a bombarding particle. Such reactions are not affected by changes of temperature or pressure. They are not altered by any physical or chemical process. Nuclear reactions are by convention written with the target element first, followed by the bombarding particle, then the emitted particle, and finally the isotope formed. Thus

$$^{14}_{7}N + ^{1}_{0}n \rightarrow ^{14}_{6}C + ^{1}_{1}H$$

would be written as $^{14}_{7}N(n, p)^{14}_{6}C$. ↓ NUCLEON · NUCLEAR ENERGY · NUCLEAR STABILITY ↑ RADIOACTIVITY

NF033 nucleon (*n.*) A term which includes proton and neutron, *i.e.* one of the two particles which give the nucleus its mass. ↓ NUCLIDE

NF034 nuclide *or* **nucleide** (*n.*) A distinct atomic species definable by the number of protons and neutrons in its nucleus, by its type of radioactive decay, and its half-life. ↑ NUCLEON

NF035 nuclear energy (*n.*) Energy associated with a nucleus or a nuclear reaction. The energy is derived from the mass lost during formation of a nucleus or released when a nucleus breaks up. Bombardment of $^{7}_{3}Li$ with high speed protons takes a course shown in the equation:

$$^{1}_{1}H + ^{7}_{3}Li \rightarrow 2\ ^{4}_{2}He$$

$$1{\cdot}007825\ M_u + 7{\cdot}016004\ M_u \rightarrow 2 \times 4{\cdot}002603\ M_u$$

$$8{\cdot}024729\ M_u \rightarrow 8{\cdot}005206\ M_u$$

This shows a mass defect of 0·019523 M_u, where M_u is atomic mass unit. This mass in kilogrammes, using the Einstein equation, will give the energy released. ↓ MASS DEFECT · BINDING ENERGY · PACKING FRACTION · NUCLEAR FISSION · NUCLEAR FUSION ↑ NUCLEAR REACTION

NF036 mass defect (*n.*) The mass of a nucleus is always slightly different from the mass of its constituent nucleons (protons and neutrons). This difference is called the mass defect. Using the masses n = 1·008665 M_u, p = 1·007276 M_u, e = 0·000549 M_u, the mass of a ^{4}He nucleus ought to be 4·032980 M_u, but the isotopic mass of ^{4}He is 4·00260 M_u. The mass defect is therefore 0·03038 M_u. This is the mass which must be converted into energy in order to form a $^{4}_{2}He$ nucleus. The value of this energy may be calculated by the use of the Einstein equation $E = mc^2$, where E = energy, m = mass, c = speed of light. ↑ NUCLEAR ENERGY

NF037 binding energy (*n.*) The work which must be done to separate the component parts of a system, or the energy released when the system is formed from the components. It is particularly applied to the energy released when an atomic nucleus is formed from its constituent nucleons. The energy is released because there is a loss of mass on formation, the mass of the stable nucleus being less than the sum of the masses of the constituent nucleons. If m is the mass defect, then the binding energy is E, given by $E = mc^2$. ↑ NUCLEAR ENERGY

NF038 packing fraction (*n.*) This is stated thus:

$$\text{packing fraction} = \frac{\text{isotopic mass} - \text{mass number}}{\text{mass number}}$$

In the case of ^{12}C the packing fraction is (arbitrarily) zero because the isotopic mass is taken to be the same as the mass number, *e.g.* packing fraction for ^{4}He

$$= \frac{4{\cdot}00260 - 4}{4} = 6{\cdot}5 \times 10^{-4}.$$

Packing fraction for ^{35}Cl

$$= \frac{34{\cdot}96885 - 35}{35} = -8{\cdot}9 \times 10^{-4}.$$

↑ NUCLEAR ENERGY

NF039 nuclear fission (*n.*) The division of a nucleus into smaller nuclei. This is usually brought about by bombardment with high energy particles, *e.g.* ^{238}U bombarded by fast neutrons gives a reaction:

$$^{238}_{92}U + ^{1}_{0}n \rightarrow ^{143}_{54}Xe + ^{94}_{38}Sr + 2^{1}_{0}n$$

Processes of this kind are accompanied by release of energy. ↑ NUCLEAR ENERGY

NF040 nuclear fusion (*n.*) Energy is produced in nuclear fusion because the masses of the products are less than the original nucleus. Mass loss results in the production of energy. If two light nuclei are combined together they form a heavier one with a corresponding release of energy because of mass loss, *e.g.*

$$^{2}_{1}H + ^{1}_{1}H \rightarrow ^{3}_{2}He + 5\ \text{MeV}.$$

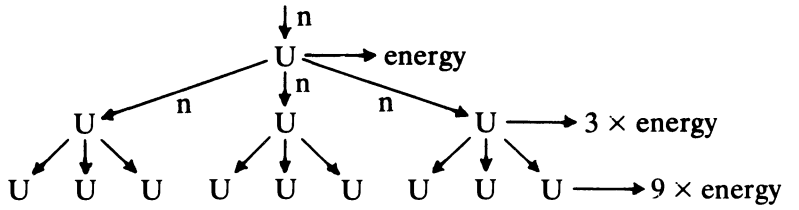
Very high temperatures (10^8 K) are necessary to make fusions of this kind economical for energy production.

$^{1}_{1}H$ 1·00782 M_u
$^{2}_{1}H$ 2·01410 M_u
3·02192 M_u
$^{3}_{2}He$ 3·01603 M_u
= a mass loss of 0·00589 M_u

This mass loss is converted into energy which is released. ↑ NUCLEAR ENERGY

NF041 nuclear stability (*n.*) Those nuclei are stable in which the number of protons and the number of neutrons are equal or nearly so. Nuclear change tends to produce a better balance of forces within the nucleus. A balance is needed between the attractive nuclear forces and the repulsive electrostatic forces between protons. Minimal packing fraction or maximal binding energy make for stability. Fall-off in stability with increasing atomic number is believed to be due to the increasing coulombic repulsion of positive protons. ↓ NUCLEAR FORCE ↑ NUCLEAR REACTION

NF042 nuclear force (*n.*) The short-range force between nucleons (protons + neutrons) in the nucleus. Nuclear forces hold the nucleons together; they must exceed the repulsive electrostatic forces between protons. ↑ NUCLEAR STABILITY



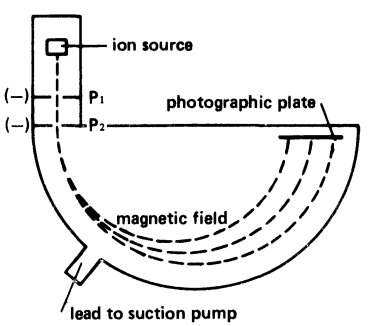
NUCLEAR CHAIN REACTION

NF043 nuclear chain reactions (*n.pl.*) A series of nuclear reactions in which one or more of the products produces further reactions, *e.g.* ^{235}U fission produces neutrons which themselves cause fission in other ^{235}U nuclei. (see diagram) The energy build up in such a process may lead to explosive release of energy as in an atomic bomb. It may lead, under controlled conditions, to a steady supply of energy as in an atomic power station. ↑ NUCLEAR FISSION · NUCLEAR REACTION

NF044 nuclear[1] (*adj.*) Describes whatever is connected with a nucleus □ *nuclear reaction; nuclear force; nuclear power station* ↑ NUCLEAR ENERGY

Mass Spectroscopy

NG001 mass spectrometer (*n.*) A piece of apparatus for separating streams of positive ions. It was devised first by Aston in 1919. The stream of ions is separated into a spectrum by using electric and magnetic fields. The modern form of the apparatus is used for obtaining relative atomic (isotopic) masses and the abundance of isotopes and relative molecular masses. The positive ions move to plate P_1 which is negatively charged. Plate P_2 is also negatively charged and maintained at a voltage of 2000 volts. The ions are now accelerated to a high and constant voltage. The ions pass through a strong magnetic field which deflects them into a curved path. The amount of deflection will depend upon the mass and charge of the ion. The tube is evacuated to a high vacuum. The ions fall on a photographic plate and produce a spectrum. The line for ^{12}C is used as the standard line against which other lines can be used to deduce the relative masses of the ions. → RELATIVE ATOMIC MASS



MASS SPECTROMETER

Sound

NH001 sound[2] (*n.*) **1** Sensation associated with the stimulation of the ear by pressure waves through the air. **2** An external cause of this sensation. Sounds are usually divided into musical and unmusical sounds. This distinction is based upon a mixture of scientific criteria and subjective ones. —*sound* (*v.*) ↓ SOUND WAVES · PROPAGATION[2] · NOISE · REFLECTION[2] · ACOUSTICS · AUDIBLE[1] → MUSICAL NOTE · MUSIC

NH002 sound waves (*n.pl.*) Sound waves may be longitudinal progressive, longitudinal stationary, or transverse stationary. For example, *a* when sound is propagated through a medium (gas, liquid, or solid) it is transmitted by progressive longitudinal

waves in that medium, viz. from a train whistle to the air; *b* in an organ pipe the sounding system is a stationary longitudinal wave in the air in the pipe; *c* a vibrating string produces a stationary transverse wave which in turn sets in vibration a volume of air in a resonating chamber or device. ↓ SYSTEMS IN VIBRATION · TRANSMISSION OF SOUND · SPEED OF SOUND · MACH NUMBER ↑ SOUND² → WAVE MOTION

NH003 systems in vibration (*n.pl.*) Systems which, because of their vibration, lead to a wave of some kind. In sound these systems may be a stretched string (as in the piano or violin), a column of air (as in a wind instrument or organ pipe), or various metallic shapes (such as tuning forks, bells, gongs, etc.). These vibrating systems by one means or another cause a longitudinal wave train in a medium which ultimately produces the sensation of sound through the ear of a hearer. ↑ SOUND WAVES

NH004 transmission of sound (*n.*) Sound is transmitted through a material medium by progressive longitudinal waves. The particles of the medium vibrate in the same direction as the progress of the wave. Successive points of high (compressions) and low (rarefactions) pressures are formed because of the regular impulses from the vibrating source, *e.g.* as in a tuning fork. In this way the changes of energy of the vibrating source are transmitted to the ear through the medium. For a very loud sound the difference between the pressure at the centre of a compression and a rarefaction is 30 Pa (compared with a pressure of 10^5 Pa standard atmosphere). ↑ SOUND WAVES

NH005 speed of sound (*n.*) The general expression for the speed of sound in any medium is:

$$\text{speed} = \sqrt{\frac{\text{elastic modulus of medium}}{\text{density of medium}}}$$

In a solid rod, the expression becomes:

$$v = \sqrt{\frac{E}{\rho}}$$

where E is Young's modulus and ρ is the density. The diameter of the rod must be small compared with the wavelength of the transmitted sound. For steel E is $2{\cdot}0 \times 10^{11}$ Pa, ρ is $7{\cdot}8 \times 10^3$ kg m^{-3}; hence v is $5{\cdot}1 \times 10^3$ m s^{-1}. In a gas the appropriate formula is:

$$v = \sqrt{\frac{\gamma p}{\rho}},$$

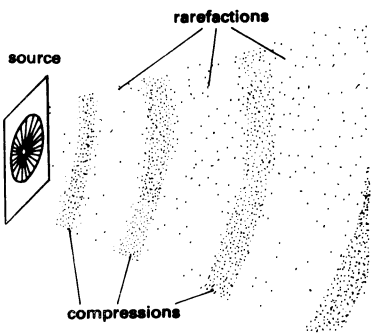
γp is equal to K, the bulk modulus, where p is the pressure of the gas, ρ is the density of the gas, and γ the ratio of specific heat capacity at constant pressure to specific heat capacity at constant volume. In air at s.t.p. the speed of sound is $3{\cdot}3 \times 10^2$ m s^{-1}. It can be shown that the expression for a gas within narrow limits of pressure may be written:

$$v = \sqrt{\frac{\gamma RT}{M}}$$

M is the relative molecular mass of the gas. The speed of sound in a gas is independent of pressure. Increase in temperature results in increase in speed of sound. Also with increasing humidity the speed of sound increases. ↑ SOUND WAVES

NH006 Mach number (*n.*) A number without units which is the ratio of the relative velocity of a body and fluid to the velocity of sound in the fluid in undisturbed conditions. Velocities for which the Mach number is above one (Mach 1) are described as supersonic. Those for which the Mach number exceeds five (Mach 5) are described as hypersonic. ↑ SOUND WAVES

NH007 propagation² (*n.*) The spreading out of sound, or a wave form, from a source. The wave spreads out because it is transmitted by a medium in which, for example for sound, a progressive longitudinal wave system is set up, and other types of wave for other energy transmissions. —PROPAGATE (*v.*) ↓ COMPRESSION · RAREFACTION ↑ SOUND²

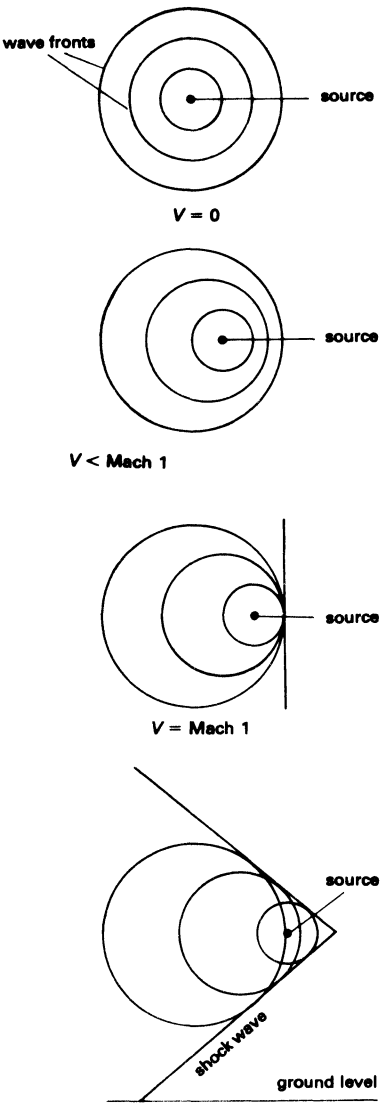


COMPRESSION AND RAREFACTION

NH008 compression (*n.*) A part of a progressive longitudinal wave in which there is a centre of zero displacement but maximum pressure in a gas, or maximum density in a solid or liquid medium. ↓ RAREFACTION ↑ PROPAGATION²

NH009 rarefaction (*n.*) A point of zero displacement but minimum pressure in a gas, or minimum density in a solid or liquid medium. ↑ PROPAGATION²

NH010 acoustic shadow (*n.*) An area in which sound is not audible because of the presence of an object. Because the wavelength of a sound wave is large compared with that of light, an acoustic shadow is not as sharp or clearly marked as an optical shadow. Diffraction takes place to a greater extent. Only if the obstacle is very large compared with the wavelength of sound will a good acoustic shadow be formed. ↑ PROPAGATION²



NH011 sonic boom (*n.*) Noise produced by the backward projected shock wave caused by an aircraft travelling at a greater speed than that of sound (Mach 1). ↑ PROPAGATION[2]

NH012 musical sound (*n.*) These are sounds which are regular, pleasant, and smooth. They are of definite pitch. They can be contrasted with unmusical sounds which are irregular, unpleasant, and rough. They are of no definite pitch. This distinction is based upon a mixture of scientific criteria and subjective criteria. ↓ NOISE · FREE VIBRATION · FORCED VIBRATION[2] · COUPLED SYSTEMS · RESONANCE[2] · WOLF NOTE · DAMPING[2] · CIRCULATION ↑ SOUND[2]

NH013 noise (*n.*) Sound lacking musical quality, or noticeably unpleasant or undesired. The loudness of noise can be measured and defined as acceptable or unacceptable. ↑ MUSICAL SOUND

NH014 free vibration (*n.*) A free vibration is one which produces a note of definite pitch which gradually dies away until the vibration ceases. During the production of the sound the pitch remains constant. The rate at which the note dies away depends upon the source. A tuning fork, for example, continues for a long time but a plucked string sounds only for a short time. ↑ MUSICAL SOUND

NH015 forced vibration[2] (*n.*) A forced vibration is produced in a vibrating system subjected to a periodic force such that the system vibrates in the period of the force. The amplitudes of such vibrations are not usually large. Thus when a violin is played the sound comes mainly from the body of the violin and the air in the body. This vibrating system (body of violin and air) produces a note of the same pitch as the vibrating string. The body of the violin and the air in it show forced vibration. They both have a free vibration of their own but are forced into the vibration of the string. Most musical instruments show a free vibration in some part and a forced vibration in another. ↑ MUSICAL SOUND

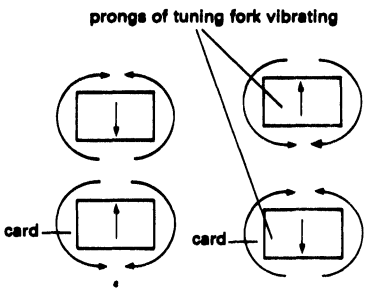
NH016 coupled systems (*n.pl.*) Vibrating systems in which the vibration of one system can be communicated to another system. Forced vibration is an example of a coupled system in which the energy in the forcing vibration is great compared with the energy in the free vibration of the forced vibration. Most musical instruments are coupled systems. ↑ MUSICAL SOUND

NH017 resonance[2] (*n.*) Resonance is the response of a vibrating system when the periodic force has the same period as the vibrating system. It is the special case of forced vibration when the two coupled systems are in unison. —***resonator*** (*n.*) ***resonate*** (*v.*) RESONATING (*adj.*) → MUSICAL NOTE

NH018 wolf note (*n.*) The special sound produced by sharp resonance in the body of a violin to notes of certain pitch. → MUSICAL NOTE

NH019 damping[2] (*n.*) **1** The progressive dying away of a wave owing to expenditure of energy. There is a progressive decrease in the amplitude of the oscillations. **2** The cause of energy loss in a system in vibration, especially when deliberately applied to bring about a rapid dying away of oscillations. The first meaning is the more important in relation to sound, *e.g.* *a* the sound from a tuning fork dies away slowly; it has

a slow rate of damping; *b* in an organ pipe the sound fades almost immediately; there is a high rate of damping in an organ pipe. —***damp*** (*v.*) ↑ MUSICAL SOUND



CIRCULATION

NH020 circulation (*n.*) As applied to sound this represents air movements set up by a vibrating system other than those in the longitudinal wave set up in the air, *e.g. a* in a tuning fork there is a movement of air around the tuning fork as well as the compressions and rarefactions; this dissipates the energy produced; *b* the diaphragm of a loud speaker is surrounded by a large baffle board to prevent circulation; *c* a stretched string produces little sound unless mounted on a soundboard. ↑ MUSICAL SOUND

NH021 reflection[2] (*n.*) Sound follows the same laws of reflection as light. Sound waves may have waves with wavelengths of several metres. Even rough surfaces which would give only diffuse reflection of light will reflect sound. Buildings, cliffs, etc., can reflect sound. High-pitched sounds give a better **echo** than low-pitched ones. —REFLECT[2] (*v.*) ***reflector*** (*n.*) ↓ ECHO · ECHELON ECHO · ECHO SOUNDING · REVERBERATION

NH022 echo (*n.*) A sound image produced when sound is reflected from a suitable surface. If the time interval between original sound and echo is less than 0·1 s, the echo will not be distinguished from the original sound. This is equivalent in air to a path difference of 30 m. ↑ REFLECTION[2]

NH023 echelon echo (*n.*) A note produced by a series of reflections from surfaces placed in a series. The succeeding echos merge to form a continuous note, the frequency of which depends upon the interval between the reflectors. A sharp tap on a pavement or hard path will be reflected from the railing or palings of the fence alongside the pavement or path. A similar effect may be produced from a flight of steps. If the vertical bars of the railings are 15 cm apart the frequency of the note will be 1100 Hz. ↑ REFLECTION[2]

NH024 echo sounding (*n.*) A method for measuring a depth of water by measuring the time between the production of a sound and the record of the echo. High pitched sounds are used. If the velocity of sound in the medium is known the distance may be calculated. ↑ REFLECTION[2]

NH025 sonic depthfinder (*n.*) An instrument for measuring the depth of water by echo sounding. ↑ REFLECTION[2]

NH026 reverberation (*n.*) The effect produced in a large hall when a sound appears to persist because the waves are reaching an observer by a number of different routes. If the reverberation is too short the room sounds dead. If however the reverberation is too long then the result is confusion. For speech sounds the best reverberation time is 0·5 s; for music 1–2 s is needed. —***reverberate*** (*v.*) ↑ REFLECTION[2]

NH027 reverberation time (*n.*) The time taken for a sound of specified standard intensity to die away to the point of being inaudible after the source has ceased to vibrate. Reverberation time in a large hall can be altered by controlled amplification of the sound. ↑ REFLECTION[2]

NH028 acoustics (*n.pl.*) The characteristics of a building concerned with its sound qualities. Satisfactory characteristics depend on the reverberation time for the room or hall. The reverberation time may be modified by altering the material of the walls, by making seating in materials similar to that of an audience. Resonance, and large curved surfaces which might focus a sound in one particular area, cause bad acoustics. ↓ REFRACTION[2] · DIFFRACTION[2] · INTERFERENCE[1] · DOPPLER EFFECT · BEAT ↑ SOUND[2]

NH029 refraction[2] (*n.*) Refraction of sound occurs at a boundary where the velocity of sound changes, therefore direction and wavelength also change. For example, at night the air near the ground is cooler than the air higher up. The velocity of sound in the warm air will be greater than the velocity of sound in the cool air. Refraction towards the earth occurs. During the day the converse happens. ↑ ACOUSTICS

NH030 diffraction[2] (*n.*) The process in which sound waves passing through an aperture spread round the corners of the aperture. A sound passing through a doorway can be heard by people not in the direct line of the doorway. The aperture is about the same as the wavelength of the sound wave if it is 1 m wide. ↑ ACOUSTICS → DIFFRACTION[1]

NH031 interference[1] (*n.*) Interference takes place with sound waves as with light waves producing areas of enhanced intensity and areas of no sound, *e.g.* when a vibrating tuning fork is held vertical near the ear and slowly rotated on a vertical axis, there are four areas of no sound in one revolution. ↑ ACOUSTICS

NH032 Doppler effect (*n.*) The apparent change in the frequency of a wave motion when there is relative motion between the source and the observer. This effect is observed in both sound waves and electromagnetic waves. The most usual case for

sound waves is that when the source is moving. The apparent change is heard by the observer as a sudden fall in pitch at the moment the source of the sound passes him. For a fast moving train or motor car emitting sound by a whistle, siren, etc., as it passes the observer, the pitch of the note drops suddenly as the train or motor car passes. ↑ ACOUSTICS

NH033 beat (*n.*) A fluctuation in sound intensity produced when two notes of almost equal frequency are sounded at the same time. The frequency of the beats is given by the difference between the two frequencies. If the difference exceeds 20 beats per second the resulting sound becomes a difference tone. ↑ ACOUSTICS → DIFFERENCE TONE

NH034 soundboard (*n.*) A board of large area on which a vibrating system may be mounted. The result is a coupled system, the board vibrating in the frequency of the forcing vibration, *e.g.* the strings of a pianoforte are mounted on a soundboard to increase the vibrating area. ↑ SOUND[2]

NH035 audible[1] (*adj.*) Describes sounds which usually can be heard by the human ear. It is possible to apply the term to sound which can be heard by an animal, but in such a case the animal would be specified. Very high pitched sounds are not audible to the human ear. —AUDIBILITY (*n.*) ***audibly*** (*adj.*) ↓ SONIC · ULTRASONIC · SUPERSONIC · HYPERSONIC · ACOUSTIC[1] · ANECHOIC · DEAD → INAUDIBLE (Ag)

NH036 sonic (*adj.*) Describes what arises from sound or applies to sound □ *sonic depth finder; sonic boom* ↑ AUDIBLE[1]

NH037 ultrasonic (*adj.*) Describes a wave or vibration with frequencies above the threshold of audibility for a normal human ear. It is applied usually to those frequencies between 20 kHz and 5 MHz. ↑ AUDIBLE[1]

NH038 supersonic (*adj.*) Usually describes velocities which exceed in value the speed of sound; applied to frequency of a note, the pitch of which is too high for audibility □ *supersonic frequency; supersonic flow* ↑ AUDIBLE[1]

NH039 hypersonic (*adj.*) Usually describes a velocity in a medium which exceeds five times the velocity of sound in the same medium under the same conditions. ↑ AUDIBLE[1]

NH040 acoustic[1] (*adj.*) **1** Describes a device, instrument, or property, connected with sound. **2** Describes phenomena associated with acoustics. ↑ AUDIBLE[1]

NH041 anechoic (*adj.*) Describes a room so constructed that no echo is produced, all walls and surfaces being so constructed as to prevent any echo by absorbing all sound energy. ↑ AUDIBLE[1]

NH042 dead (*adj.*) (Of sound) describes a room or hall which is completely without resonance, as in one where all echo has been suppressed. ↑ AUDIBLE[1]

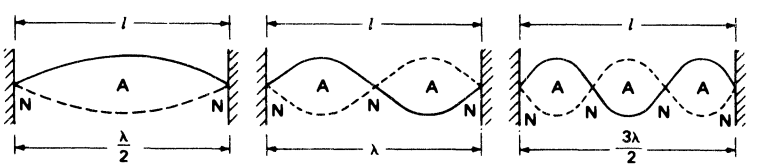
NH043 musical note (*n.*) A musical note arises from a system in vibration producing vibrations which are regular and repeating. A musical note has three characteristics, viz. loudness, pitch, and quality (or timbre). There are three important aspects of the musical note: the vibrating source, the transmission through a medium, reception by the hearer. ↓ FREQUENCY[2] · PITCH[2] · DECIBEL · AURAL HARMONICS · SONOMETER · LOUD → MUSIC · SOUND[2]

NH044 frequency[2] (*n.*) The frequency of a vibrating source producing sound is the number of vibrations completed in one second. Applied to a progressive longitudinal wave transmitting the sound, it is the number of compressions which pass a given point in one second. A piano string sounding middle C, is vibrating at 256 vibrations per second. The longitudinal wave in air which transmits the sound to the ear of an observer is such that 256 compressions pass a given point in one second. ↓ INTENSITY[2] · FUNDAMENTAL[2] · OVERTONES · HARMONIC · PARTIALS · UNISON · TONE[2] ↑ MUSICAL NOTE → SOUND[2]

NH045 intensity[2] (*n.*) The rate of flow of energy through a unit area perpendicular to the direction of travel of the sound. Intensity is proportional to the square of the amplitude of vibration of the air. The unit of intensity is the **decibel.** ↑ FREQUENCY[2]

NH046 fundamental[2] (*n.*) The predominant frequency in a note which enables the note to be named; it is always accompanied by other frequencies of lower intensity which determine the quality of the note. The fundamental is the component of lowest frequency. —***fundamental*** (*adj.*) ↑ FREQUENCY[2]

NH047 overtones (*n.pl.*) Those notes which accompany the fundamental and give quality to a note. The intensity of the overtones is less than that of the fundamental. The frequencies of the overtones are multi-



OVERTONES

ples of the fundamental frequency. ↑ FREQUENCY[2]

NH048 upper partials (*n.pl.*) Alternative term for OVERTONES (↑).

NH049 harmonic (*n.*) An oscillation of a vibrating system, the frequency of which is a whole number multiple of the fundamental. As applied to a note, it is a tone having a frequency which is a whole number multiple of the fundamental tone. —***harmonic*** (*adj.*) ↑ FREQUENCY[2]

NH050 partials (*n.pl.*) These may correspond with tones of the harmonic series (1:2:3:4, etc.). The tones above the fundamental are known as overtones or upper partials. Some vibrating systems, of which the bell is one, produce partials which are not in the harmonic series. All harmonics are partials but not all partials are harmonics, *e.g.* in a bell studied by Rayleigh the frequency ratios were 1, 1·5, 2·0, 2·7, 3·3. ↑ FREQUENCY[2]

NH051 unison (*n.*) Notes are in unison when they have the same fundamental frequency, *i.e.* the same pitch. ↑ FREQUENCY[2]

NH052 tone[2] (*n.*) The individual sounds of specific frequency which make up a musical note. They may be the fundamental (usually the most prominent) and the overtones or partial tones. A pure tone consists of one frequency only. ↑ FREQUENCY[2]

NH053 pitch[2] (*n.*) Pitch is the subjective quality of a sound which determines its position in a musical scale. It is a sensation experienced by a listener. Pitch depends upon the frequency of air vibrations and therefore upon the frequency of the vibrating source. A high frequency gives a note of high pitch and a low frequency gives a note of low pitch. ↓ LOUDNESS · QUALITY[3] · TIMBRE · ABSOLUTE PITCH · AUDIBILITY[1] · THRESHOLD OF AUDIBILITY ↑ MUSICAL NOTE → SOUND[2]

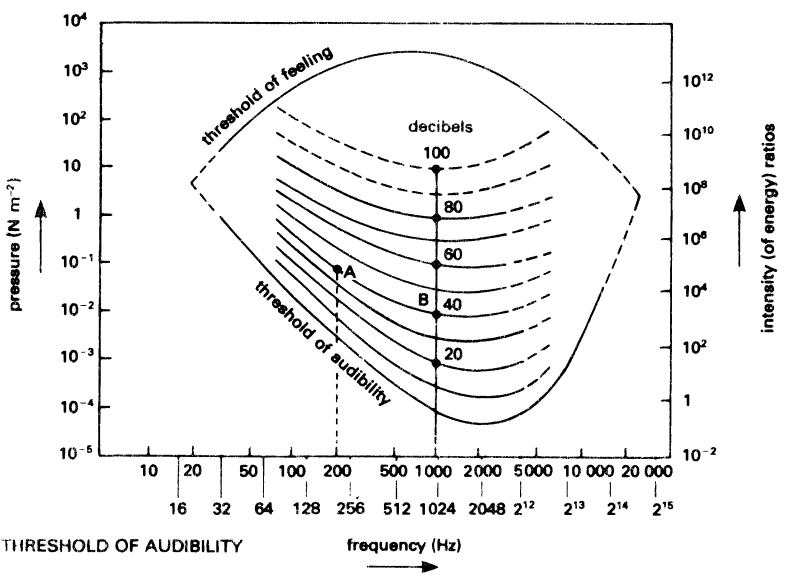
NH054 loudness (*n.*) A subjective sensation which depends upon the intensity of the sound and the sensitivity of the ear of the observer. Equal increments of loudness are not obtained by adding equal increments of intensity but by multiplying equal increments of intensity by the same factor. The range of loudness distinguished by the human ear covers 130 phons. It has been suggested that very, very soft, in musical terms, should correspond to 20 phons, while very, very loud should be 95 phons. ↑ PITCH[2]

NH055 quality[3] (*n.*) The quality of a note is that characteristic which allows the observer to identify the class of instruments producing the note or, in special cases, to distinguish between two instruments of the same group. Thus notes produced on a trumpet and on an oboe are easily distinguished because of their different qualities. Different wave forms are obtained for the notes on a cathode ray oscilloscope. This indicates that in addition to the fundamental note there are different mixtures of overtones. It is the number and intensity of these overtones which determine the quality of the note. ↑ PITCH[2]

NH056 timbre (*n.*) Alternative term for QUALITY as applied to a musical note (↑).

NH057 absolute pitch (*n.*) A sense possessed by some observers of being able to place a note in its correct position on a musical scale. It is different from the ability to judge the interval between two notes. ↑ PITCH[2]

NH058 audibility[1] (*n.*) The ability to hear sounds. ↑ PITCH[2]



NH059 threshold of audibility (*n.*) A level of sound sensitivity above and below which an ear cannot perceive sound. More precisely, the intensity for any given frequency when a sound is just audible. The range of frequencies for the human ear is from 20 Hz to 20 000 Hz. The diagram shows that threshold intensities vary with frequency. At 3500 Hz the minimum pressure amplitude at the threshold is 0·0008 Pa. Note that the loudness of a sound is determined by its frequency and its pressure amplitude, for example, a sound (A) of frequency 200 Hz having a pressure of 10^{-1} N m^{-2} will have the same loudness (40 dB) as a sound (B) of 1000 Hz and 10^{-2} N m^{-2}. ↑ PITCH²

NH060 decibel (*n.*) *or* **dB** (*abbrev.*) A logarithmic unit for comparing two sound intensities. If I_1 and I_2 are the intensities of two notes, then the difference of intensity level is $\log_{10}\frac{I_1}{I_2}$ bels or $10\log_{10}\frac{I_1}{I_2}$ decibels.

One decibel represents an increase in intensity of 26%. The decibel is not a measure of loudness. ↓ PHON ↑ MUSICAL NOTE → SOUND²

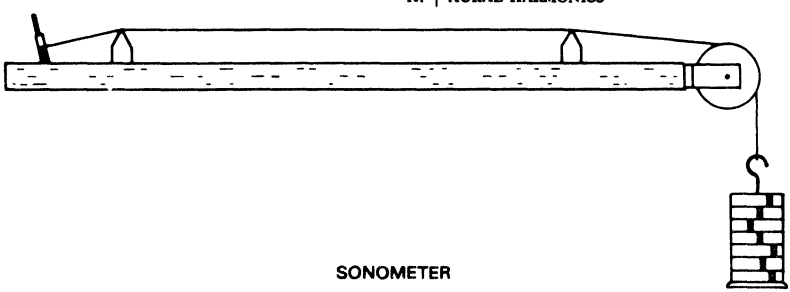
NH061 phon (*n.*) A unit of equivalent loudness of sound. The loudness of a sound which has the same loudness as a reference tone for which the R.M.S. sound pressure is 2×10^{-5} Pa and frequency 1000 Hz (threshold of intensity for this frequency). The phon is on a subjective scale depending upon the judgement of equal loudness by an observer. The phon and decibel scales are not identical as the sensitivity of the ear changes with frequency. Between 500 and 10 000 Hz there is close correspondence. ↑ DECIBEL

NH062 aural harmonics (*n.pl.*) If a system is asymmetric then when acted upon by a periodic force of frequency f_1 it adds frequencies $2f_1$, $3f_1$, $4f_1$, etc. The ear behaves as an asymmetric system and so produces the harmonics. Such harmonics are called aural harmonics. ↓ COMBINATION TONE · SUMMATION TONE · DIFFERENCE TONE ↑ MUSICAL NOTE

NH063 combination tone (*n.*) The pure tone which results from the simultaneous sounding of two other tones. Such tones appear to be caused by double forcing of asymmetric systems. When the ear is the asymmetric system they can be called aural combination tones. ↑ AURAL HARMONICS

NH064 summation tone (*n.*) A combination tone whose frequency is the sum of the frequencies of the notes which produce it. ↑ AURAL HARMONICS

NH065 difference tone (*n.*) A combination tone whose frequency is the difference of the frequencies of the notes which produce it. ↑ AURAL HARMONICS



SONOMETER

NH066 sonometer (*n.*) A device for studying the acoustic behaviour of stretched strings. It consists of a wooden sounding box with pegs for the strings. One string passes over a pulley to be attached to a weight for stretching the string. ↓ BRIDGE · RIDER · KUNDT'S TUBE · GALTON'S WHISTLE ↑ MUSICAL NOTE → EQUATION

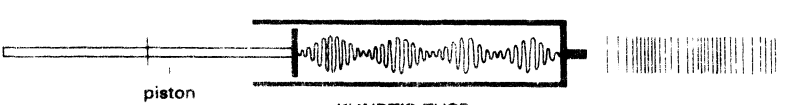
NH067 bridge (*n.*) A small device fitted to a sonometer and to some instruments using vibrating strings. It is attached to the sounding board part of the instrument and the strings pass over it. The point of contact between string and bridge forms a node. ↑ SONOMETER

NH068 rider (*n.*) A small V-shaped piece of light metal or paper. It is sometimes placed on a beam of a balance to obtain a third or fourth place reading. In experiments in sound it is used to find nodes and antinodes in stretched strings. It is light enough not to interfere with the vibration of the string. ↑ SONOMETER

NH069 formula² (for a stretched string) (*n.*) The frequency of a stretched string is given by the expression:

$$f = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

where f is the frequency in hertz; l is the length of the vibrating string in metres; T is the tension of the string in newtons; μ is mass per unit length in kilogrammes per metre.



KUNDT'S TUBE

NH070 Kundt's tube (*n.*) A piece of apparatus used for measuring the velocity of sound in a gas. The rod is set in vibration by stroking. In the tube a very fine powder shows the positions of the rarefactions and compressions. This allows the wavelength to be measured. The rod frequency can be determined by tuning to a sonometer. The length of the gas column can be varied with the piston. ↑ SONOMETER

NH071 Galton's whistle (*n.*) A miniature organ pipe which can be blown by the mouth like a whistle. The pitch of the note may be raised above the threshold of human audibility by a screw. The frequency of the note produced can be read off on the whistle. ↑ SONOMETER · THRESHOLD OF AUDIBILITY

NH072 tune[2] (*v.t.*) To adjust the frequency of one or other of two vibrating systems to bring them into unison. The notes produced will have the same pitch and will not produce beats. ↑ FREQUENCY[2] · MUSICAL NOTE

NH073 loud (*adj.*) Describes a sound above normal loudness. Normal loudness will depend upon an individual. From the feeblest sound to the loudest there is a range of 130 phons. It has been suggested that 60 phons represents normal loudness. —LOUDNESS (*n.*) ↓ SOFT[1] ↑ MUSICAL NOTE → SOUND[2]

NH074 soft[1] (*adj.*) Describes a sound which is not loud, *i.e.* less than 60 phons of loudness. ↑ LOUD (Ag)

NH075 music (*n.*) One of the fine arts. It is concerned with the combination of musical sounds according to the pattern governed by the culture of those giving expression to the art. The instruments used vary from culture to culture. Some forms of music are acceptable across cultures while other forms, because of their different combinations, sound strange to the alien ear. ↓ MUSICAL INSTRUMENT · VIBRATING AIR COLUMN · VIBRATING STRING · SCALE · NOTE · TEMPERAMENT · STRUCK ↑ MUSICAL NOTE → SOUND[2]

NH076 musical instrument (*n.*) A device for producing musical sounds. Musical instruments may be, *a* those using vibrating strings; *b* those which use vibrating columns of air; *c* those using vibration in wood, metal, or stretched membranes. A cross-classification may be made on the basis of method of generation of the sound, namely by bowing, by plucking, or by striking, though this does not include vibrating air columns. ↓ STRINGED INSTRUMENTS · WIND INSTRUMENTS · PERCUSSION INSTRUMENTS · PIANOFORTE ↑ MUSIC → SOUND[2]

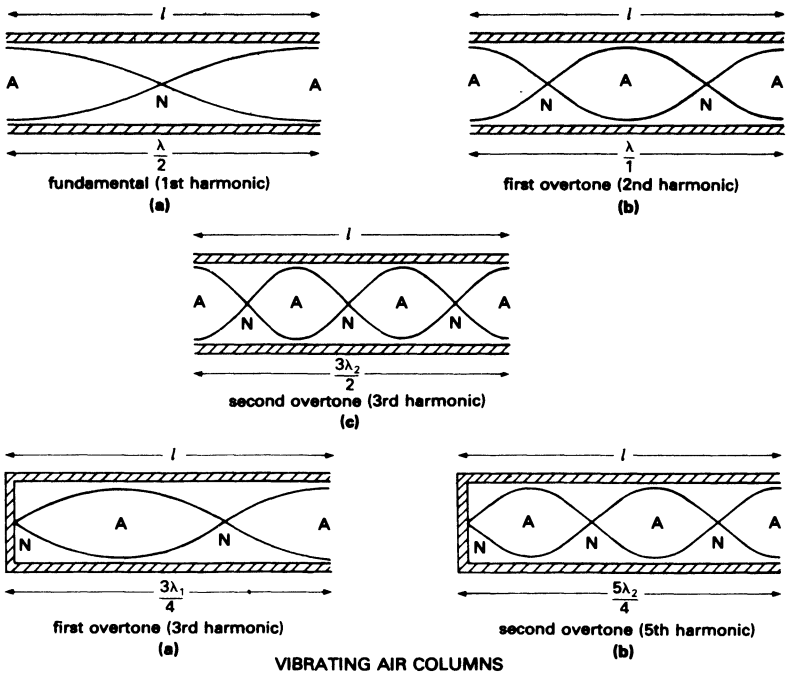
NH077 stringed instruments (*n.*) This class of musical instruments goes far back in history. They may be plucked, bowed, or struck. The pianoforte (piano) and the harpsichord have strings of fixed length The piano strings are struck by hammers. The harpsichord strings are plucked. Other musical instruments also use plucked strings but the length of the string is varied by stopping, *i.e.* by causing a node. Such instruments include the guitar, sitar, etc. A very important group of stringed instruments is those which are bowed. They are the violin, the viola, the violincello (cello), and the double bass. They differ in the range of frequencies they cover, the violin having the highest and the double bass the lowest. ↑ MUSICAL INSTRUMENT

NH078 wind instruments (*n.*) These may be divided into woodwind and brass. The former are made of wood and the latter of metal, usually brass, but sometimes silver. They differ in the method of producing the vibration and in the shape of the air column. Brass instruments differ in the method of varying the length of the air column. The trombone has a slide which alters the length of the column; the trumpet has valves which introduce additional sections of air column. Brass instruments use the lips as a double reed to set the system in vibration. Woodwind instruments, such as the clarinet and oboe, use reeds of different kinds which determine their quality. The organ is a wind instrument consisting of pipes of metal or wood. It may reproduce the quality of different wind instruments and to some extent strings. It is said to be of four tones: flute tone, diapason tone, string tone, and reed tone. ↑ MUSICAL INSTRUMENT

NH079 percussion instruments (*n.pl.*) These are instruments which themselves are struck rather than having strings which are struck. They include vibrating bars, membranes, and metals in bulk (as distinct from strings). The instrument which depends upon struck bars is the xylophone. They are a graduated series resting on supports. Important features are the length and stiffness of the bar at its antinode. The tuning fork also uses a struck bar to produce its sound. Stretched membranes are used in drums of various kinds. It is a coupled system in which the struck membrane forces the opposing membrane to vibrate, and so on until all the energy is used up. Cymbals, bells and gongs are of metal and are tuned to one pitch, though they have different mixtures of partials and so different qualities. ↑ MUSICAL INSTRUMENT

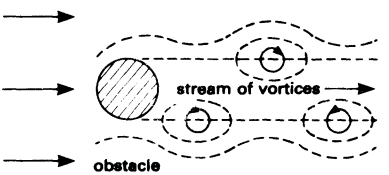
NH080 pianoforte (*n.*) A stringed instrument in which the strings are struck. It can be played softly (**piano**) or loudly (**forte**). ↑ MUSICAL INSTRUMENT

NH081 vibrating air colnmn (*n.*) An air column in a tube or pipe vibrates in stationary longitudinal waves. A number of devices are used to set the column of air vibrating. Among these are an edge producing edge tones as the forcing vibration, and reeds which are set in vibration and in turn force the column into vibration. A closed end forms a node; an open end an antinode. The end at which the initial vibrations are set up will also be an antinode. The formation of the fundamental and the first and second overtones are shown in the diagram. ↓ EDGE TONE · AEOLIAN TONE · REED[2] · FLUE AND REED ORGAN PIPES · END CORRECTION



VIBRATING AIR COLUMNS

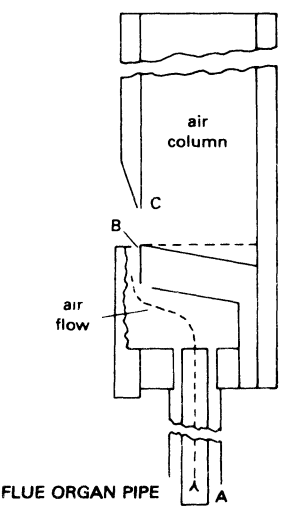
NH082 edge tone (*n.*) The sound produced when a flat thin stream of air strikes an edge. The air issues from a linear slit. The frequency of the sound is related to the number of vortices reaching the edge each second. This type of tone is produced in flue organ pipes. The edge tone and the pipe form a coupled system. ↑ VIBRATING AIR COLUMN



AEOLIAN TONES

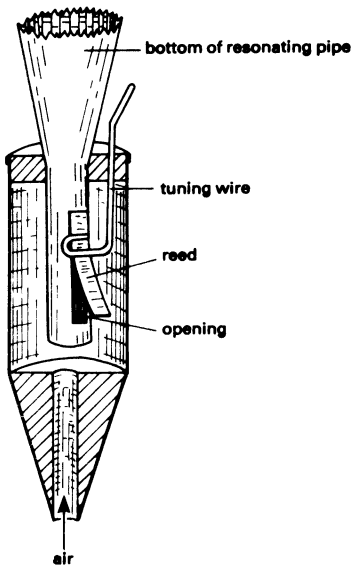
NH083 aeolian tone (*n.*) The tones produced when a stream of air flows past an obstacle of cylindrical cross section. The frequency of the note depends upon the speed of air flow and upon the diameter of the obstacle. ↑ VIBRATING AIR COLUMN

NH084 reed[2] (*n.*) A small bar of cane or metal fixed at one end. This is set into transverse vibration by wind pressure. The frequency of the note emitted depends upon the material of the reed and its dimensions. There are two kinds, beating reeds and free reeds. In the beating reed, the reed vibrates against an air hole or slot, so stopping the flow of air at certain points in its vibration. The free reed vibrates through the slot which is slightly larger than the reed. In a double reed there is a slight space between the two reeds and the air passes between them. Reeds form the generating source of a number of coupled systems, as for example in the clarinet with a single beating reed, and in the oboe with a double reed. The lips form a double reed for brass instruments. Reeds produce reed tone. ↑ VIBRATING AIR COLUMN



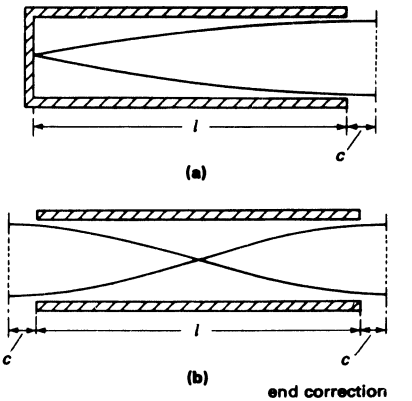
FLUE ORGAN PIPE

NH085 flue organ pipe (*n.*) A type of organ pipe which operates by producing edge tones. (See diagram.) Air from bellows A passes through the linear slit B and hits the edge C, producing edge tones; these in turn set the air column in vibration. The pipes may be open or stopped (closed). Metal pipes are circular in cross section; wooden pipes are square in cross section. ↑ VIBRATING AIR COLUMN



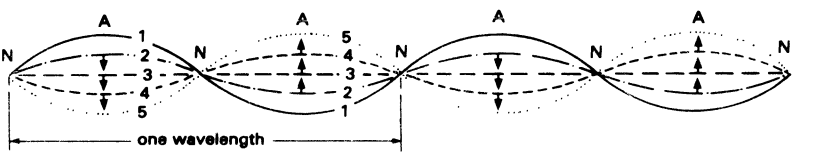
REED ORGAN PIPE

NH086 reed organ pipe (*n.*) An organ pipe in which the forcing vibration is produced by a beating reed. The reed acts as a closed end. An open reed pipe acts like a flue pipe closed at its top end. Reed pipes vary in shape (cylindrical to conical) according to the quality needed. ↑ VIBRATING AIR COLUMN



END CORRECTION

NH087 end correction (*n.*) The length which must be added to the actual length of a pipe to give the effective length of the vibrating air column in the pipe. The value of *c* may be taken as 0·6 *r*, where *r* is the radius of the pipe, *e.g.* to obtain the fundamental frequency of a closed pipe (**a**) $\lambda/4 = l + c$ and for an open pipe (**b**) $\lambda/2 = l + 2c$ (end correction at both ends). ↑ VIBRATING AIR COLUMN



VIBRATING STRING

NH088 vibrating string (*n.*) A string stretched between two points, vibrating in stationary transverse vibration. This in turn sets up a longitudinal wave in the air with a frequency equal to that of the transverse wave on the string. In a musical instrument this weak vibration is transmitted to a sounding board/box which causes a larger mass of air to vibrate. The string is usually fixed at one end while the other end has a device for increasing the tension. The string can vibrate so that each end is a displacement node and the centre a displacement antinode. This produces the fundamental note and the length of the string is half the wavelength. The frequency will be $\frac{v}{2l}$ where v = speed of the transverse wave and l = length of the string. If the string is plucked at the point $\lambda/4$ from the end, the wavelength of the resulting wave will be equal to l, the length of the string. The frequency will now be doubled, producing an octave. This is the first overtone. Other harmonics are obtained if the string is appropriately plucked or bowed. If the string vibrates in three segments it produces the second overtone. Stretched strings vibrate according to the law:

$$f = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

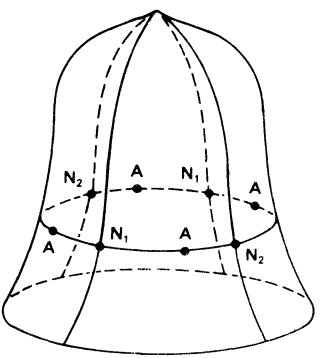
f = frequency in hertz,
l = length in metres,
T = tension of the string in newtons,

μ = mass per unit length of the string in kilogrammes per metre. ↓ STRING · NODE[2] · ANTINODE[2] · BELL · GONG[1] ↑ MUSIC

NH089 string (*n.*) A tightly-stretched wire or length of gut which may be struck, bowed or plucked to produce a note. ↑ VIBRATING STRING

NH090 node[2] (*n.*) The point at which particle displacement, particle velocity, or pressure amplitude, has a minimum value, *e.g.* ***a*** in a vibrating string vibrating in its fundamental frequency, the bridge is a position of minimum particle displacement, *i.e.* a node; ***b*** in an organ pipe closed at one end there is a point of minimum pressure amplitude for the air of the pipe. —***nodal*** (*adj.*) ↓ ANTINODE[2] (P) ↑ VIBRATING STRING

NH091 antinode[2] (*n.*) The point at which particle displacement, particle velocity, or pressure amplitude, has a maximum value, *e.g.* ***a*** for a vibrating string, vibrating in its fundamental frequency, there is an antinode at the point equidistant between the two points where the string is fixed; ***b*** for an organ pipe closed at one end, maximum pressure is found at the end where the forcing vibration is; ***c*** in a vibrating column open at both ends there are antinodes at both ends. ↑ NODE[2] (P) · VIBRATING STRING



N_1, N_2 nodes

A antinodes

N_1A. . .N_2A nodal circle:
gives rise to longitudinal vibrations

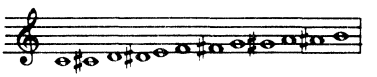
N_1 N_1 N_2 N_2 nodal meridians:
give rise to transverse vibrations

Clapper causes A (antinode) where it strikes

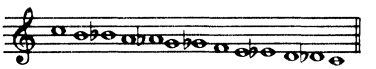
BELL

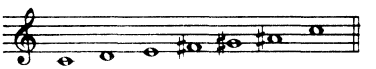
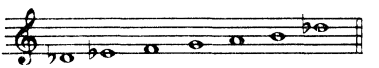
NH092 bell (*n.*) The metal of a bell is usually three parts copper and one part tin (small brass and silver bells are also made) The bell has a thickened part near the open end called the **sound bow**. It is on this part that the clapper or hammer strikes it. Both longitudinal and transverse vibration occur. The point where the clapper strikes the bell will be an antinode. Nodes for the longitudinal vibration will be antinodes for the transverse vibration. ↑ VIBRATING STRING

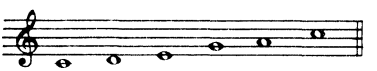
NH093 gong[1] (*n.*) A circular sheet of metal turned up at the edges and often turned inwards as well. A set of gongs is tuned to a five or seven tone scale. ↑ VIBRATING STRING

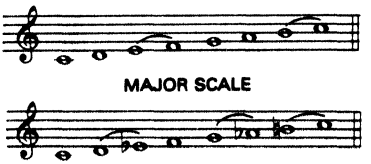


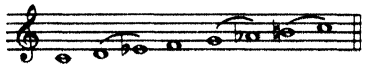
CHROMATIC (MELODIC) SCALE



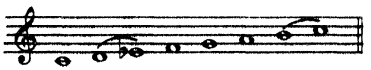
CHROMATIC (HARMONIC) SCALE



WHOLE TONE SCALES

PENTATONIC (5-line) SCALE

NH094 scale[3] (*n.*) A series of notes selected so that their frequencies form a definite whole number series. They have developed as the process of making music has developed. All scales appear to have an octave as one of the intervals. This is then divided into degrees by the other notes of the scale. In Western music a scale is used divided between octaves into 7 degrees by other notes. In the scale of C major, these are the notes corresponding to the white keys on the piano. The earliest record of scales is of those used by the Greeks. These were called modes and they were used and developed in the church music up to the fourth century. Five tone scales are found in Amerindian music and Chinese music. In India a complex series of tones developed involving halftones and quarter tones. Individual appreciation of particular scales is a matter of use. Those accustomed to Western music and its major and minor diatonic scales and its chromatic scale seldom appreciate the music written in different scale systems. ↓ DIATONIC SCALE · INTERVAL[2] · TONE[1] · SEMITONE · KEYBOARD SCALE · DISSONANCE · CONSONANCE · HARMONY[2] → MUSIC

MAJOR SCALE



MINOR (HARMONIC) SCALE

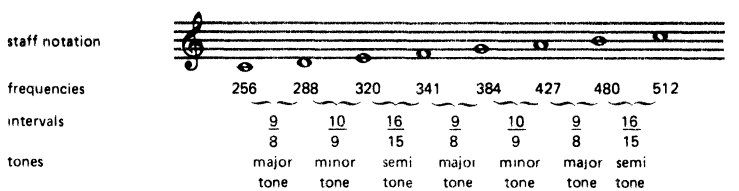


MINOR (MELODIC) SCALE

NH095 diatonic scale (*n.*) The scale which in any key proceeds by the notes proper to that key without chromatic alteration. Such a scale is made up of two tones followed by a semitone, followed in turn by 3 tones followed by a semitone. In the key of C, c–d–e–f–g–a–b–c, c–d is a major tone; d–e is a minor tone, but e–f is a semitone. Similarly f–g is a major tone, g–a is a minor tone, a–b is a major tone, and b–c is a semitone. The diatonic scale may be major or minor, the latter being divided into melodic and harmonic. → SCALE[3]

NH096 interval[2] (*n.*) The difference in pitch between two notes. Intervals are expressed numerically: a third, fourth, fifth, etc. They are major or minor depending upon whether they are part of a major diatonic or minor diatonic scale. The ratio of frequencies between the two notes is a measure of the interval. ↑ SCALE[3]

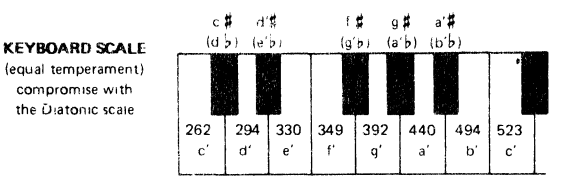
NH097 tone[1] (*n.*) The interval of a major second. The ratios for major and minor tones are shown in the diagram. ↑ SCALE[3]

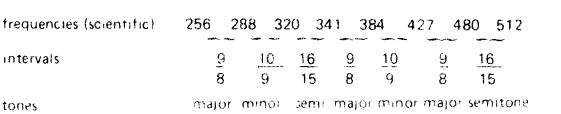


DIATONIC SCALE

NH098 semitone (*n.*) An interval which has a frequency ratio 1·067 for a diatonic semitone and 1·0595 for a chromatic semitone. The interval f–g on the scale C major is a diatonic semitone. The interval C–C ♯ is a chromatic semitone. ↑ SCALE[3]

NH099 keyboard scale (*n.*) An equally tempered scale tuned so that a chromatic semitone has a frequency ratio of 1·0595; it is used on the pianoforte and the organ. ↑ SCALE[3]




frequencies (scientific)
256 288 320 341 384 427 480 512
intervals
9/8 10/9 16/15 9/8 10/9 9/8 16/15
tones
major minor semi major minor major semitone

KEYBOARD SCALE

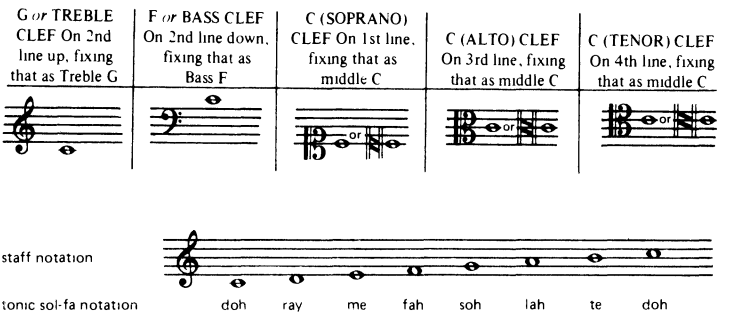
NH100 dissonance (*n.*) The sensation when two notes are sounded together and the combination is unpleasant to the human ear. This is the result of beats with frequency in excess of six per second. Such beats will be produced by the different partials of the two notes. Dissonance will depend upon the interval between beating partials and upon their strength. —***dissonant*** (*adj.*) ↑ SCALE[3]

NH101 consonance (*n.*) The sensation experienced when two notes are sounded simultaneously and the combination is pleasing to the human ear. —***consonant*** (*adj.*) ↑ SCALE[3]

NH102 harmony[2] (*n.*) The combination of notes together so that the result shall be pleasing to the human ear. The term is also applied to the study of the combinations of notes. ↑ SCALE[3]

NH103 note (*n.*) **1** The written sign which represents the pitch and duration of a musical sound. **2** A single musical sound of definite pitch. **3** (Of a pianoforte) alternative term for KEY. ↓ TONE[3] · NOTATION → MUSIC

NH104 tone[3] (*n.*) The quality of a musical sound described in such subjective terms as poor tone, good tone, loud tone, thin tone. ↑ NOTE


G or TREBLE CLEF On 2nd line up, fixing that as Treble G
F or BASS CLEF On 2nd line down, fixing that as Bass F
C (SOPRANO) CLEF On 1st line, fixing that as middle C
C (ALTO) CLEF On 3rd line, fixing that as middle C
C (TENOR) CLEF On 4th line, fixing that as middle C
or
staff notation
tonic sol-fa notation
doh ray me fah soh lah te doh

NOTATION

NH105 notation (*n.*) A method of recording music. It is based on naming the notes by letters. It also includes methods of distinguishing the value of notes in terms of duration. A system of rests (periods of no sound) corresponds to the note symbols. A piece of music is written on a five line frame, each note represented by its symbol placed in the correct position. For choral music a number of frames (staves) may be used, for pianoforte music two staves. For organ music there are three staves. At the beginning of the line are symbols to indicate the key (first note of the diatonic scale) and the time signature (indication of the rhythm). Symbols also are used to indicate position in the scale, *e.g.* treble clef, alto clef, and bass clef.

NH106 temperament (*n.*) The adjustment of tuning in keyboard instruments so that the intervals in the diatonic scales may be the same whatever the tonic or key note.

Diatonic scales, frequencies in Hz:
(C major)

C	D	E	F	G	A	B	C[1]
264	297	330	352	396	440	495	528

(D major)

D	E	F♯	G	A	B	C[1]♯	D[1]
297	334	371	396	445	495	557	594

If a keyboard instrument had enough keys to satisfy each scale it would be too complex to play. The scale can be modified so that the differences are levelled out without seriously spoiling the pitch differences. The scale is said to have equal temperament.

Scale C:

C	D	E	F	
261·6	293·7	329·6	349·2	Hz
G	A	B	C[1]	
392·0	440	493·9	523·3	Hz

Rounded off:
262 294 330 349 392 440 494 523 Hz.

Another effect is that the pairs of notes B♯ and C, C♯ (277) and D♭ (282), are combined rather than treated as individual notes. —***temper*** (*v.*) ***tempered*** (*adj.*)

NH107 tonic (*n.*) The first note of a scale, *e.g.* in the scale of C (major or minor) the tonic is the note C. ↑ TEMPERAMENT

NH108 keynote (*n.*) Alternative term for TONIC. ↑ TEMPERAMENT

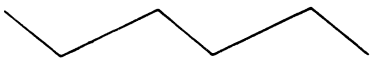
NH109 octave (*n.*) The note whose frequency bears a ratio 2/1 to the tonic or key note in a diatonic scale. ↑ TEMPERAMENT

NH110 third (*n.*) The interval between the tonic and the third note in the scale. The major third has a ratio 9/8 with the tonic. The minor third has a ratio 10/9. ↑ TEMPERAMENT

NH111 fifth (*n.*) The interval between the tonic and the fifth note on the scale. The ratio of the frequencies is 3/2. The interval of a fifth is the same for major and minor

scales. For this reason it is called a perfect fifth. ↑ TEMPERAMENT

NH112 struck (*adj.*) Describes the vibrating string caused to vibrate by a hammer of wood, leather, and felt, or a similar device striking it. When the wire is struck at a node for a particular partial that partial is suppressed. When it is struck at an antinode for a partial the partial is made more prominent. The most effective position seems to be 0·12 of its length. —***strike*** (*v.*) ↓ BOWED · PLUCKED



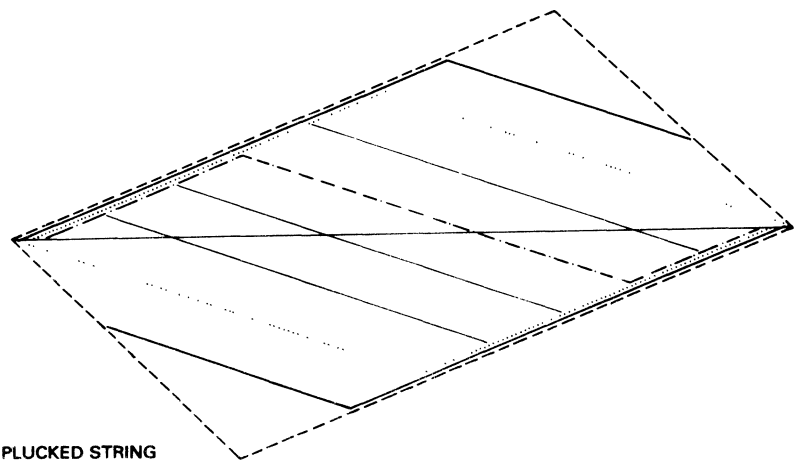
BOWED STRING

NH113 bowed (*adj.*) Describes a string set in vibration by a bow. The bow consists of long horse hairs fixed at their ends to a piece of wood. Drawn over the string they pull it to one side. As the tension of the string increases it slips past the bow. The bow is then drawn back again and the movement is repeated. —***bow*** (*n.*) ***bow*** (*v.*) ↑ STRUCK

NH114 plucked (*adj.*) Describes a string set into vibration by plucking. The string is pulled aside by a finger or piece of horn or metal and set free. This is the method well-known in playing the guitar. Quality of tone varies with the instrument used for plucking. A mellow tone results from plucking by fingers whereas a hard tone results from horn or metal devices. The motion of the plucked string is shown in the diagram. ↑ STRUCK

NH115 diatonic (*adj.*) Describes a modern musical scale or a semitone in such a scale. The term means literally at the interval of a tone; applied in Greek music to the scale as used on the Greek tetrachord divided in two whole tones and a half tone. ↑ STRUCK

NH116 chromatic (*adj.*) Describes a scale which includes notes not part of the corresponding diatonic scale. Describes also the semitone between the notes of the tones of a diatonic scale. C–C♯, C♯ –D, D–D♯, etc., are chromatic semitones. ↑ STRUCK



PLUCKED STRING

NH117 sharp[3] (*adj.*) (symbol ♯) Describes a note one chromatic semitone above a given note. If that note is already described as a sharp, *e.g.* C ♯, the chromatic semitone above is C ♯ ♯ (C double sharp). In the scale of equal temperament (on the pianoforte) C ♯ ♯ is the same as the note D (or E ♭♭). See diagram of **keyboard scale**. Sharp singing or string playing departs from correct tone on the upward side.

NH118 flat (*adj.*) (symbol ♭) Describes a note which is lower in pitch by a chromatic semitone, *e.g.* the note below D is D ♭, which corresponds to C ♯; D ♭♭ will be the same as C. See diagram of **keyboard scale**. ↑ STRUCK

Current Electricity

NJ001 electricity (*n.*) **1** The study of the phenomenon of electric charge, whether the charge is stationary or moving. Current electricity is the study of phenomena associated with moving electric charges. Static electricity is the study of phenomena associated with stationary electric charges. **2** (G.S.) Electric current or static electric charge. —ELECTRIC, ELECTRICAL (*adj.*) ↓ ELECTRIC CHARGE · ELECTRICAL ENERGY · CURRENT ELECTRICITY · ALTERNATING CURRENT · CURRENT BALANCE · ELECTRIC · RESISTANCE[2] · CIRCUIT · GALVANOMETER · THERMOELECTRICITY → ELECTROMAGNETISM · ELECTRONICS

NJ002 electric charge (*n.*) A property of

elementary particles. Electric charge may be of two kinds, called **positive** and **negative** charge. Like charges, *i.e.* two positive or two negative charges, repel each other; unlike charges, *i.e.* one positive and one negative, attract each other. Electric charge is discrete, *i.e.* there is a quantity of charge which cannot be sub-divided; all other quantities of charge are multiples of this smallest quantity (the charge on an electron). Atoms can become charged through gaining or losing electrons and behave as charged particles; an accumulation of charged particles constitutes an electric charge. The quantity of electric charge is measured in coulombs. The symbol for quantity of electric charge is *Q*. ↓ ELECTRIC CURRENT · CONDUCTOR · NONCONDUCTOR · INSULATOR ↑ ELECTRICITY → COULOMB

NJ003 electric current (*n.*) Electric charges in motion form an electric current. The electric current is equal to the quantity of electric charge passing a given point in unit time. The charges may be either positive or negative. In electrical circuits, the flow of electric charge is considered to be a flow of electrons along a conductor or through a conducting medium. An electric current is measured in amperes. By convention an electric current is considered to flow from the positive pole of an electric cell to the negative pole. The flow of electrons constituting the current is in the opposite direction. All references to the direction of current flow assume the conventional direction. The symbol for electric current is *I*. ↑ ELECTRIC CHARGE → AMPERE

NJ004 conductor (*n.*) A body made of a material which readily allows an electric current to flow through it. A conductor will distribute an electric charge over its surface. The most important class of conductors consists of the metals; another important class consists of electrolytes. —CONDUCT (*v.*) ***conducting*** (*adj.*) ↓ NONCONDUCTOR (An) · INSULATOR (An) ↑ ELECTRIC CHARGE → ELECTROLYTE · SEMICONDUCTOR

NJ005 nonconductor (*n.*) A material which does not allow electric charge to flow through it or allow electric charge to be distributed over its surface. —NONCONDUCTING (*adj.*) ↑ ELECTRIC CHARGE

NJ006 insulator (*n.*) An object made of material which is a nonconductor; the term is particularly used of any object or device which prevents a flow of electric current. ↑ ELECTRIC CHARGE

NJ007 electrical energy (*n.*) Electrical energy is produced, *a* from chemical potential energy in an electric cell; *b* from mechanical energy in a dynamo; *c* from light energy in a photocell; *d* from the vibrational energy of a sound wave in a microphone. All these devices can produce a continuous supply of electrical energy, which drives an electric current through a conductor or a circuit. The electrical energy is dissipated as heat energy in the conductor or circuit, or may result in the production of other forms of energy. Electrical energy is measured in joules (watt-seconds) or in kilowatt-hours; it is equal to the product of the electromotive force and the quantity of charge passing through a battery, or similar device, to produce an electric current. ↓ ELECTRIC POWER · POTENTIAL DIFFERENCE · VOLTAGE · HIGH TENSION · LOW TENSION · p.d. · H.T. · L.T. ↑ ELECTRICITY → ELECTROMOTIVE FORCE

NJ008 electric power (*n.*) The power of an electrical device is the energy transformed in unit time. Electric power is measured in watts; the symbol for it is *P*.

electrical energy = QV

$$\text{power} = \frac{\text{energy}}{\text{time}}$$

$$\text{electric power} = P = \frac{E}{t} = \frac{QV}{t} = \frac{ItV}{t}$$

$$= VI$$

Power in watts is obtained by multiplying potential difference in volts by current in amperes. ↑ ELECTRICAL ENERGY

NJ009 potential difference (*n.*) The difference in potential between any two points in a circuit. The flow of electric current in a conductor or electrical circuit is from points of higher potential to points of lower potential. The difference between any two points can be considered to be an electrical *pressure* which drives the electric current from one point to the next. The potential difference between two points is equal to the energy transformed from electrical energy to other forms of energy per unit electric charge that passes between the two points. Potential difference is measured in volts. The symbol for potential difference is *V* □ *a potential difference exists across a conductor; a potential difference is applied to a device; the potential difference across the ammeter is 20 volts; a potential difference of 10 volts between the ends of the resistor* ↑ ELECTRICAL ENERGY

NJ010 voltage (*n.*) The electromotive force, or potential difference, or electric potential, stated in volts. ↑ ELECTRICAL ENERGY

NJ011 high tension (*n.*) A high voltage supplied usually by a battery. The term is generally used to describe the voltage supplied to the anode and cathode of a discharge tube or a thermionic tube; also used to describe voltages in a grid distribution system. ↑ ELECTRICAL ENERGY

NJ012 low tension (*n.*) A low voltage supplied usually by an accumulator or from an a.c. supply. The term is generally used to describe the voltage supplied to a filament in a thermionic tube. ↑ ELECTRICAL ENERGY

NJ013 p.d. (*abbr.*) Abbreviation for POTENTIAL DIFFERENCE (↑).

NJ014 H.T. (*abbr.*) Abbreviation for HIGH TENSION (↑).

NJ015 L.T. (*abbr.*) Abbreviation for LOW TENSION (↑).

NJ016 current electricity (*n.*) 1 The study of electric current, both direct current and

alternating current. **2** Current electricity as opposed to static electricity. ↓ DIRECT CURRENT · d.c. ↑ ELECTRICITY

NJ017 direct current (*n.*) A steady flow of electric current in one direction only. ↑ CURRENT ELECTRICITY

NJ018 d.c. (*abbr.*) Abbreviation for DIRECT CURRENT.

NJ019 alternating current (*n.*) A current flowing in a circuit which reverses direction many times a second; it is caused by an alternating e.m.f. acting in a circuit and reversing many times a second. The variation of current (or of e.m.f.) with time, as produced by a public electricity supply, approximates closely to a sinusoidal wave form, *i.e.* a sine curve. ↓ CURRENT CYCLE · PEAK VALUE · ROOT-MEAN-SQUARE VALUE · r.m.s. · a.c. ↑ ELECTRICITY

NJ020 current cycle (*n.*) One complete cycle of variation of an alternating current in which the sine wave completes one period of oscillation. The cycle determines the frequency of the alternating current. Frequency used to be stated in cycles per second but is now stated in hertz (Hz). ↑ ALTERNATING CURRENT

NJ021 peak value (*n.*) The maximum value of the e.m.f. or of the current in either direction in a circuit conducting alternating current. ↑ ALTERNATING CURRENT

NJ022 root-mean-square value (*n.*) (Of an alternating current or alternating voltage) the square root of the mean value of the square of the current, or voltage, taken over a whole cycle of the alternating current. The relation between peak value and r.m.s. value is:

$$\text{r.m.s. value} = \frac{\text{peak value}}{\sqrt{2}} = 0{\cdot}707 \text{ peak value.}$$

The peak current (I_0) and the r.m.s. current ($I_{\text{r.m.s.}}$) are related thus:

$$I_{\text{r.m.s.}} = 0{\cdot}707\ I_0.$$

A similar relationship exists for voltages:

$$V_{\text{r.m.s.}} = 0{\cdot}707\ V_0$$

↑ ALTERNATING CURRENT

NJ023 r.m.s. (*abbr.*) Abbreviation for ROOT-MEAN-SQUARE VALUE. ↑ ALTERNATING CURRENT

NJ024 a.c. (*abbr.*) The abbreviation for ALTERNATING CURRENT (↑).

NJ025 current balance (*n.*) An instrument for determining accurately the magnitude of an electric current through measurement of a mechanical force. It consists of two similar coils attached to the ends of a balance arm; above and below each of these coils is a fixed coil. All six coils are connected in series so that the flow of current applies a torque to the beam. The beam is returned to its original position by moving a rider along the beam. The moment of the rider is equal to the torque caused by the current, and the magnitude of the current is calculated from the definition of the ampere. ↑ ELECTRICITY → AMPERE

NJ026 electric (*adj.*) Describing a specified phenomenon or a specified device that produces or uses electric charge or electric current. An electric arc is an example of a phenomenon that uses electric charge. An electric bell is an example of a device that uses electric current. An electric cell is a device that produces electric current. An electric force is a phenomenon that exists between two electric charges □ *an electric arc; an electric battery; an electric bell; an electric cell; an electric current; an electric current; an electric lamp; an electric shock; an electric spark; an electric storm; an electric wind; an electric dynamo; an electric motor; an electric generator; electric potential; electric lines of force* —ELECTRICAL (*adj.*) ***electrically*** (*adv.*) ELECTRICITY, ***electrician*** (*n.*) ↓ ELECTRICAL ↑ ELECTRICITY

NJ027 electrical (*adj.*) Electrical is the adjective used, **1** with the names for persons working at a trade; **2** with words which are inclusive words, *e.g.* devices, repairs, etc.; **3** with measurements and measuring instruments; **4** with words having an indefinite or general implication, *e.g.* circuits. For example, ***a*** an electrical engineer; ***b*** electric motors are electrical devices; ***c*** the electrical unit of charge is the coulomb; ***d*** unlike electrical charges attract one another. Compare the following usage of **electric** and **electrical. 1** An electric circuit is completed to test an ammeter. (This is a specified device, *i.e.* a specified circuit.) **2** Electrical circuits (a general reference to all circuits) will not conduct electric currents if they have faulty connections □ *electrical energy; electrical standards; electrical quantities; electrical units* —***electrically*** (*adv.*) ↑ ELECTRIC

NJ028 resistance[2] (*n.*) In all types of electric conduction the motion of electric charge is impeded by its interaction with stationary molecules or atoms in the conducting device; this causes resistance to the electric current, and a proportion of the electrical energy is dissipated as heat energy in overcoming this resistance. For conductors, the greater the potential difference between the ends of the conductor, the greater will be the electric current; the extent to which the conductor resists the current depends on, ***a*** the nature of the material; ***b*** its temperature; ***c*** its physical dimensions; ***d*** (in some cases) the energy of light or other radiation falling upon it. For metal conductors, Ohm's law applies to measurement of resistance; for other types of conductors, and for electrical devices, Ohm's law does not apply. Resistance is the property of a conducting body or of a device; it is measured in ohms. The symbol for resistance is R □ *a resistance is high or low* —***resistive*** (*adj.*) ↓ RESISTOR · RESISTIVITY · CONDUCTANCE[1] (An) · TERMINAL[2] ↑ ELECTRICITY → COIL[2]

NJ029 resistor (*n.*) A device used in an electrical circuit mainly on account of its property of resistance. Resistors are made, ***a*** of wire wound on an insulator; ***b*** of finely ground carbon with a ceramic powder to bind it. To compare **resistor, resistance**, and

resistivity: a resistor is the body or device that possesses the property of resistance, and is a component of an electrical circuit; resistance is the property of the body, and is measured in ohms; resistivity is the property of the material from which the body is made and is measured in ohm metres □ *a resistor made from copper wire having a resistance of 20 ohms; the resistivity of the copper is 1·69 × 10⁻⁸ ohm m* ↓ STANDARD RESISTOR · VARIABLE RESISTOR · RHEOSTAT · POTENTIAL DIVIDER · RESISTANCE WIRE ↑ RESISTANCE[2]

NJ030 standard resistor (*n.*) A resistor whose resistance and temperature coefficient of resistance are known accurately. A standard resistor is used to measure the resistance of other non-standard resistors. ↑ RESISTOR

NJ031 variable resistor (*n.*) A resistor whose resistance can be altered between a range of values; it can be used as a rheostat or as a potential divider. ↑ RESISTOR

NJ032 rheostat (*n.*) A variable resistor used as a component in an electrical circuit to vary the current flowing in the circuit. ↑ RESISTOR

NJ033 potential divider (*n.*) A variable resistor used to control the p.d. across an electrical device; it supplies a p.d. between a range of values. ↑ RESISTOR

NJ034 shunt[2] (*n.*) A resistance connected in parallel with an electrical component or instrument, *e.g.* a resistor connected in parallel with a galvanometer is a shunt for the galvanometer. A shunt reduces the electric current through the device to which it is connected. —SHUNT (*v.*) ***shunted*** (*adj.*) ↑ RESISTOR

NJ035 resistance wire (*n.*) Wire made of an alloy of high resistivity and with a low temperature coefficient of resistance (the change in resistance with temperature is small). Nichrome and manganin are alloys used. Resistance wire is used to make wire resistors. ↑ RESISTOR

NJ036 resistivity (*n.*) The disposition (a property) of a conducting material by which it resists the flow of electric current. It is defined as the resistance of a metre cube at 0°C, and is a constant for a given material at a stated temperature. The symbol for resistivity is ρ.

$$\rho = \frac{RA}{l}$$

where R is the resistance, A is the area of cross-section, and l is the length of a uniform conductor of the material. Resistivity is measured in ohm-metres; it increases with temperature. ↓ INTERNAL RESISTANCE · OHM'S LAW · SPECIFIC RESISTANCE ↑ RESISTANCE[2]

NJ037 internal resistance (*n.*) The electrical resistance of a device producing an electromotive force. In an electric cell some of the electrical energy is dissipated in driving the electric current through the cell. This is measured as the internal resistance of the cell. Internal resistance of a cell reduces the electromotive force of the cell to the p.d. between the poles of the cell. ↑ RESISTIVITY

NJ038 Ohm's law (*n.*) A steady current flowing through a metallic conductor, which is not itself the site of an electromotive force, is proportional to the potential difference between the ends of the conductor, provided the temperature and other physical conditions remain constant. For a metallic conductor, the ratio

$$\frac{\text{potential difference}}{\text{current}}$$ remains constant

for all values of the current, at a constant temperature; the ratio is the resistance of the conductor. For electrical devices not obeying Ohm's law, the ratio changes with varying currents. The resistance of a metallic conductor is given by:

$$R = \frac{V}{I}$$

Ohm's law is usually expressed as $V = IR$; the statement is valid for an electrical circuit, for any component in the circuit, and at any one particular temperature, or other physical condition. ↑ RESISTIVITY

NJ039 specific resistance (*n.*) Obsolete term for RESISTIVITY (↑).

NJ040 conductance[1] (*n.*) The conductance of a conductor, or an electrical device, with direct current, is the reciprocal of its resistance. The symbol for conductance is G, and the property is measured in reciprocal ohms (Ω^{-1}). The conductance of a circuit, in which an alternating current flows, is its resistance divided by the square of its impedance; this quantity is also measured in reciprocal ohms. —***conducting*** (*adj.*) CONDUCT (*v.*) ↓ CONDUCTIVITY[1] · SUPERCONDUCTIVITY · TRANSITION TEMPERATURE · SUPERCONDUCTOR · SPECIFIC CONDUCTANCE ↑ RESISTANCE[2] (An) → IMPEDANCE

NJ041 conductivity[1] (*n.*) The disposition (a property) of a conducting material by which it conducts electricity. It is the reciprocal of the resistivity, *i.e.*

$$\text{conductivity} = 1/\text{resistivity}$$

The symbol for conductivity is κ (the Greek letter kappa). Conductivity is chiefly used in studying the behaviour of electrolytes in solution; it is measured in reciprocal ohms per metre, *i.e.* $\Omega^{-1}\ m^{-1}$. ↑ CONDUCTANCE[1] → ELECTROLYTE

NJ042 superconductivity (*n.*) The resistivity of all metals and alloys decreases as the temperature is lowered, and tends to become zero at the absolute zero of temperature. Certain metals and alloys, such as lead, tin, and vanadium, exhibit the phenomenon of superconductivity, in which the property of resistance is lost at temperatures a few degrees above absolute zero, the change in resistance being abrupt. The metal is said to become superconducting, and it is a perfect conductor; a current induced in a ring of superconducting metal continues to circulate after the inducing magnetic field is withdrawn, and such cur-

rents have been maintained for several months. —***superconducting*** *(adj.)* SUPERCONDUCTOR *(n.)* ↑ CONDUCTANCE[1]

NJ043 transition temperature *(n.)* The temperature, a few degrees above absolute zero, at which a metal or alloy becomes superconducting. ↑ CONDUCTANCE[1]

NJ044 superconductor *(n.)* A metal, alloy, or object, that exhibits superconductivity. ↑ CONDUCTANCE[1]

NJ045 specific conductance *(n.)* Obsolete term for CONDUCTIVITY[1] ↑ CONDUCTANCE[1]

NJ046 terminal[2] *(n.)* A metal projection, such as a nut, mounted on a screw thread, at the end of a wire or a conductor, or connected to a device; it is used for making a connection with an electrical circuit, by fastening a piece of wire to it. ↓ PLUG[2] · FLEXIBLE CORD · FLEX[2] · LEAD[1] · CONTACT[2] ↑ RESISTANCE[2]

NJ047 plug[2] *(n.)* A piece of metal, with an insulating knob, which can be pushed into a socket to make contact for completing an electrical circuit. A wire, or conductor, is usually attached to the plug. ↑ TERMINAL[2]

NJ048 flexible cord *(n.)* A bundle of thin wires, covered with insulating material (plastic or rubber), used to connect parts of a circuit which are far apart. The cord is completely flexible and can be bent round objects to make the connection; it is usually attached to a plug or a terminal. For example, a flexible cord is used to connect an electric iron to a mains socket on the wall. ↑ TERMINAL[2]

NJ049 flex[2] *(n.)* Alternative term for FLEXIBLE CORD ↑ TERMINAL[2]

NJ050 lead[1] *(n.)* A wire used to make connections in an electrical circuit; it is usually long in order to connect a particular device to a circuit. ↑ TERMINAL[2]

NJ051 contact[2] *(n.)* **1** The action of touching or of being put in touch, for the purpose of closing an electrical circuit so that current can flow □ *when the wires touch, contact is made—when the wires do not touch, contact is broken; depress the switch to make contact.* **2** The part of an electrical device which makes contact to complete a circuit, *e.g.* the metal points on a tapping key which touch when the key is depressed. Contact points are made of metal with a high melting point, as heat may be generated by sparking when contact is made or broken □ *a loose contact does not conduct well; a firm, or good, contact should always be made in a circuit; an electric current will not flow if the contact is faulty.* ↑ TERMINAL[2]

NJ052 coil[2] *(n.)* Wire wound round a former in rings, or just wound in a helical manner, forms a coil. The length of a coil is very much shorter than its diameter. Coils are used in electrical circuits for their electromagnetic effect. ↓ TURN[3] · ELEMENT[3] ↑ RESISTANCE[2] → AMPERE-TURN · GEOMETRY

NJ053 turn[3] *(n.)* One ring of a coil. A coil with 20 turns has 20 circular rings of wire, placed one after the other along a former. Although the wire is wound in the shape of a helix, it is regarded as possessing a number of complete circular turns. ↑ COIL[2]

NJ054 element[3] *(n.)* A coil of resistance wire used to heat an electrical appliance such as an electric iron or an electric stove. The coil is wound on insulating, heat-proof material, such as mica or porcelain. ↑ COIL[2]

NJ055 circuit *(n.)* The complete path which can be followed by an electric current; it generally consists of a number of components connected by wires acting as conductors offering little resistance to the current □ *a circuit is closed to allow current to flow; when a circuit is open, no current flows; a circuit is connected up using various components; when electric current flows through a circuit, the circuit is made; a component is incorporated in a circuit; a circuit is broken when current can no longer flow* ↓ COMPONENT[2] · SWITCH · FUSE[2] · SERIES · RESISTANCE BOX · CONNECT[2] · INSULATE[2] · INSULATING ↑ ELECTRICITY

NJ056 component[2] *(n.)* A general term for any electrical device used in a circuit, *i.e.* a circuit is formed by connecting components. Components include resistors, capacitors, electric cells, meters for measurement, switches, etc. ↓ PRINTED CIRCUIT · INTEGRATED CIRCUIT · MICROCIRCUIT · SOLID-STATE COMPONENT · SHORT CIRCUIT[1] ↑ CIRCUIT

NJ057 printed circuit *(n.)* An electrical circuit in which the conductors between components, and certain fixed components, are printed on an insulating board. Such a circuit is made by covering the insulating board with a thin coat of copper, covering the circuit and components photographically with a protective film, and then dissolving away the unprotected copper in an acid bath; when the protective film is removed, the circuit remains. ↑ COMPONENT[2]

NJ058 integrated circuit *(n.)* A circuit incorporated in a chip of a semiconductor forming a system of components; such a circuit replaces separate transistors and associated components in electronic circuits. ↑ COMPONENT[2] → SEMICONDUCTOR · TRANSISTOR

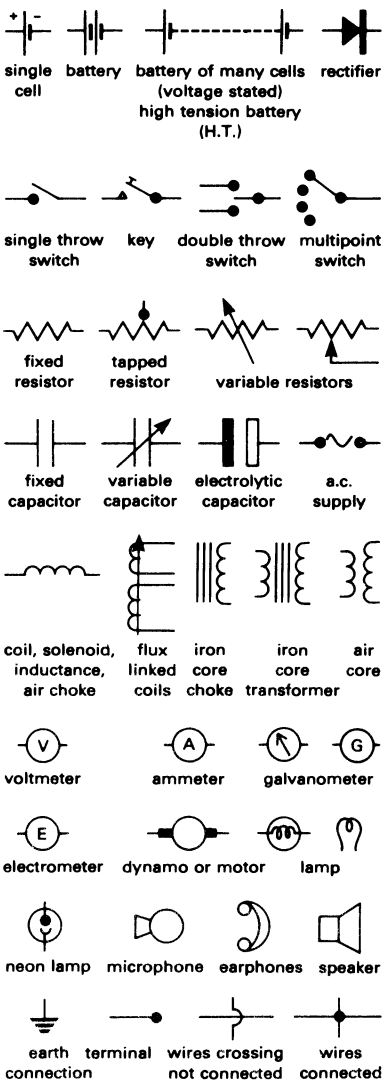
NJ059 microcircuit *(n.)* Alternative term for INTEGRATED CIRCUIT. ↑ COMPONENT[2]

NJ060 solid-state component *(n.)* An electric device in an electrical circuit consisting mainly or exclusively of semiconducting materials. Such components are concerned with semi-conductivity (transistors), photoconductivity (photo-electric effect), etc. The term is used in contrast to thermionic devices. ↑ COMPONENT[2] → THERMIONIC TUBE · TRANSISTOR

NJ061 short circuit[1] *(n.)* If two points, X and Y, are in a system of components forming an electrical circuit, there is a definite resistance between the points. If X and Y are connected by a conductor of much lower resistance, or are placed in contact, then current flows directly between X and Y and a short circuit is formed. The electrical circuit is then short-circuited, or ***shorted.***

—***short circuit*** (*v.*) ↑ COMPONENT[2]

NJ062 switch (*n.*) An electrical device for connecting one part of a circuit to another part; this is called a single-throw switch. When the switch is closed, a closed circuit is formed; when the switch is open, an open circuit is formed. Some types of switch can connect a component, or components, to either one of two alternative circuits; this is called a double-throw switch. A switch which connects a circuit with a single wire conductor is a single-pole switch. If the circuit has two wire conductors and the switch connects both circuits at the same time, it is a double-pole switch □ *the switch closes to make the circuit; the switch opens to disconnect the circuit* ↓ TAPPING KEY · CLOSED CIRCUIT · OPEN CIRCUIT ↑ CIRCUIT



ELECTRICAL CIRCUIT COMPONENT SYMBOLS

NJ063 tapping key (*n.*) A stiff piece of brass, with an insulating knob, which can be depressed to make contact and complete a circuit; it is a form of switch which must be operated manually to close it. The term ***key*** is often used in place of tapping key. ↑ SWITCH

NJ064 closed circuit (*n.*) An electrical circuit in which there is a continuous path of conductors, or other devices, along which an electric current flows. ↓ OPEN CIRCUIT (An) ↑ SWITCH

NJ065 open circuit (*n.*) An electrical circuit in which there is a break in the path of conductors, or other devices, so that no electric current flows in the circuit. ↑ SWITCH

NJ066 fuse[2] (*n.*) A safety device incorporated in an electrical circuit to prevent too high a current flowing through the circuit. It consists of a piece of wire, made of metal with a low melting point, connected in series in the circuit. An excessive current raises the temperature of the wire causing it to melt and break the circuit. ↓ FILAMENT[2] · ELECTRIC LIGHT BULB · CUT-OUT · INSULATION ↑ CIRCUIT

NJ067 filament[2] (*n.*) A fine wire with a high resistance; it is heated by the passage of an electric current. Filaments are used in electric-light bulbs and in thermionic tubes. ↑ FUSE[2]

NJ068 electric light bulb (*n.*) A filament mounted in a glass bulb; the bulb is usually filled with an inert gas at low pressure. The filament is usually made of tungsten, or of some other metal of high melting point. The passage of an electric current heats the wire to a high temperature and it becomes incandescent. ↑ FUSE[2]

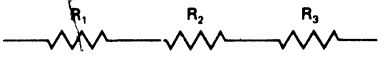
NJ069 cut-out (*n.*) A device in an electrical circuit which can be operated electromagnetically by an increasing current, or by other conditions, so that it automatically opens a circuit and stops the passage of current; used as a safety device, *e.g.* to prevent overheating of an electrical appliance. —***cut-out*** (*v.*) ↑ FUSE[2]

NJ070 insulation (*n.*) **1** The prevention of the passage of an electric current, or heat, by the use of non-conducting material. **2** The actual material, or the actual object, used for the purpose of insulation, *e.g.* a wire for conducting electric current is covered with rubber or plastic; the rubber, or plastic, is insulation round the wire, as these materials are nonconductors. ↑ FUSE[2]

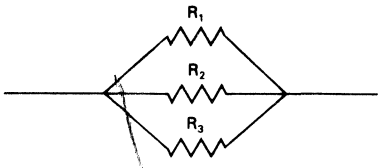
NJ071 series (*n.*) A method of connecting components in an electrical circuit so that the electric current will flow through each in turn, one after the other. The total resistance of a set of resistances in series is given by the equation:

$$R = R_1 + R_2 +, \text{ etc.}$$

☐ *the resistors are connected in series*
↓ PARALLEL[2] · KIRCHHOFF'S LAWS ↑ CIRCUIT



resistors in series



resistors in parallel

SERIES AND PARALLEL

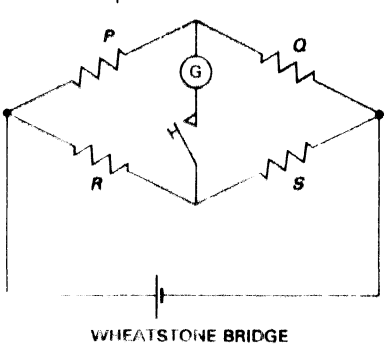
NJ072 parallel[2] (*n.*) A method of connecting electrical devices in an electrical circuit so that the electric current must divide to flow through each of the devices at the same time, and then reunite. The overall resistance of a number of resistances in parallel is given by the equation:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} +, \text{ etc.}$$

☐ *the resistors are connected in parallel*
↑ SERIES

NJ073 Kirchhoff's laws (*n.pl.*) The laws which state that when steady currents are flowing in a network of conductors, **1** the algebraic sum of the electric currents entering any point in the network is zero; **2** the algebraic sum of the products of current and resistance taken round any closed path in the network is equal to the algebraic sum of the e.m.f.s acting in that path. ↑ SERIES

NJ074 resistance box (*n.*) A set of standard resistors connected by a thick brass bar, mounted in a box. Plugs in sockets connect the resistors in series; removal of a plug puts the resistor in circuit. Using the box, a standard resistance can be put in circuit. Values of the resistances are 1, 2, 5, 10, 20, 100, 1000 ohms, etc. Each resistor is wound non-inductively so that the box can be used with a.c. ↓ WHEATSTONE BRIDGE · METRE BRIDGE · POST OFFICE BOX · POTENTIOMETER · BOLOMETER[2] ↑ CIRCUIT



WHEATSTONE BRIDGE

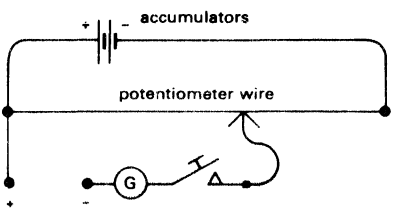
NJ075 Wheatstone bridge (*n.*) A network of resistors for quick and accurate measurement of resistance. Four resistors are connected in the form of a quadrilateral; a source of e.m.f. is connected across one diagonal of the quadrilateral and a galvanometer and tapping key across the other diagonal. The resistances of the resistors are adjusted until no current flows through the galvanometer; the bridge is then said to be balanced. When balanced the relation between the values of the four resistances is

$$\frac{P}{Q}$$

Practical versions of the Wheatstone bridge are the metre bridge and the Post Office box. ↑ RESISTANCE BOX

NJ076 metre bridge (*n.*) This device consists of a uniform wire, usually one metre long, mounted on a board with its ends connected to a copper strip with two gaps in which resistors can be connected. The two resistors correspond to *P* and *Q* in the Wheatstone bridge; the wire corresponds to *R* and *S*. A sliding contact is moved along the wire until the bridge is balanced; the two lengths of the wire then correspond to resistors *R* and *S*. ↑ RESISTANCE BOX

NJ077 post office box (*n.*) A resistance box is used for resistor *Q* in the Wheatstone bridge network. Resistors *R* and *S* are represented by two sets of standard resistances of values 10,100, and 1000 ohms, so the ratio of *R*/*S* can be 100, 10, 1, 0·1, 0·01. The unknown resistance is connected to two terminals and becomes resistor *P*. The cell, tapping key, and galvanometer, are connected inside the Post Office box. The bridge is balanced as for the Wheatstone bridge. ↑ RESISTANCE BOX



POTENTIOMETER

NJ078 potentiometer (*n.*) An instrument used primarily for comparing e.m.f.'s or potential differences; it can be adapted to measure currents and resistances. Its simplest form consists of a uniform resistance wire through which a steady current is passed by one or more accumulators. The p.d. (or e.m.f.) to be measured is connected to the wire, using a contact maker, so that the two potential differences act in opposition. A point of balance is found where the two p.d.'s exactly balance; this is indicated by a galvanometer, connected to the p.d. under measurement, having no deflection. The ratio of the two potential differences is

proportional to their respective lengths of potentiometer wire. The instrument can measure e.m.f.s, as, at the point of balance, a cell is on open circuit, with no current passing through it. ↑ RESISTANCE BOX

NJ079 bolometer[2] (*n.*) A very sensitive instrument for measuring radiant heat. It consists of two very thin, blackened, platinum strips arranged in a grid; one grid is mounted behind a cone, and radiant heat falls on it, heating the metal, and altering its resistance. The two grids are two resistors in a Wheatstone bridge circuit, and radiant heat falling on the grating upsets the balance of the bridge and is detected. ↑ RESISTANCE BOX → THERMOPILE[2]

NJ080 connect[2] (*v.t.*) To join components of a circuit by means of conductors. ↓ DISCONNECT (I) · SWITCH ON · SWITCH OFF ↑ CIRCUIT

NJ081 disconnect (*v.t.*) To remove conductors between components, or to remove a conductor so that a component is no longer in a circuit, *e.g.* a voltmeter is connected to the terminals of a battery by wires; if a wire, or both wires, are removed, the voltmeter is disconnected from the battery. ↑ CONNECT[2] (I)

NJ082 switch on (*v.t.*) To close a switch and make a circuit. ↑ CONNECT[2]

NJ083 switch off (*v.t.*) To open a switch and break a circuit (*i.e.* produce an open circuit). ↑ SWITCH ON (I) · CONNECT[2]

NJ084 insulate[2] (*v.t.*) **1** To prevent an electric current flowing to places where it is not required or not desired. **2** To prevent heat, light, sound, etc., going to places where they are not required. ↓ SHORT CIRCUIT[2] · SHORT ↑ CIRCUIT

NJ085 short circuit[2] (*v.t.*) To cause a short ciruit to be formed. ↑ INSULATE[2]

NJ086 short (*v.t.*) Alternative term for SHORT CIRCUIT[2] (↑).

NJ087 insulating (*adj.*) Describes a material, or a structure, which insulates an object from an electric current. Thus, a circuit is mounted on an insulating board so that the components are insulated electrically from each other. ↓ NON-CONDUCTING ↑ CIRCUIT

NJ088 non-conducting (*adj.*) Describes the property of a material. Contrast **insulating**: when a non-conducting material is used to insulate an object from an electric current, it becomes an insulating material. ↑ INSULATING

NJ089 galvanometer (*n.*) An instrument for detecting electric current, but not calibrated to measure current. It has a scale and can be used to compare currents. The mechanism depends usually upon the magnetic effect of an electric current, *e.g.* moving-coil and moving-iron galvanometers. ↓ AMMETER · OHMMETER ↑ ELECTRICITY

NJ090 ammeter (*n.*) An instrument calibrated to measure the strength of an electric current in amperes; it is connected in series in a circuit and ideally should have a zero resistance. In practice, it is a galvanometer converted by a resistance in parallel with the instrument and the scale calibrated in amperes. In moving iron instruments, a piece of soft iron is moved by the attraction of a solenoid; such an instrument can measure either d.c. or a.c. A moving-coil instrument is more accurate but can only be used with d.c. It consists of a coil suspended between the poles of a permanent magnet, current passing through the coil deflects it, and the deflection is proportional to the current. ↓ VOLTMETER · MILLIAMMETER · MILLIVOLTMETER · BALLISTIC GALVANOMETER · ELECTROMETER · ELECTROSTATIC VOLTMETER · HOT-WIRE INSTRUMENT ↑ GALVANOMETER

NJ091 voltmeter (*n.*) An instrument for measuring the potential differences between two points, calibrated to read volts; it is connected in parallel with the two points and ideally should have an infinite resistance. In practice, a galvanometer is converted to a voltmeter by a high resistance in series with the instrument, and the scale calibrated in volts. Both moving-iron and moving-coil instruments are used, the former for both a.c. and d.c., the latter for d.c. only. Other forms of voltmeter include, ***a*** diode valve voltmeter, recording peak values of the applied p.d.; ***b*** the cathode ray oscilloscope. ↑ AMMETER

NJ092 milliammeter (*n.*) An ammeter designed to measure electric current in milliamperes (mA). ↑ AMMETER

NJ093 millivoltmeter (*n.*) A voltmeter designed to measure potential differences in millivolts (mV). ↑ AMMETER

NJ094 ballistic galvanometer (*n.*) A type of galvanometer which measures the total quantity of electric charge arising from a momentary current. The duration of the current must be short compared with the period of oscillation of the coil. An undamped moving-coil galvanometer is generally used. ↑ AMMETER

NJ095 electrometer (*n.*) An instrument for measuring voltage differences; it uses no current at all. It consists of two sets of parallel vanes, interleaved with one another; one set is fixed to a base, the other set is free to rotate on a bearing. The p.d. is applied to the two sets of vanes, electrostatic forces draw the sets of vanes together and a scale records the potential difference in volts. The instrument is essential for measuring electrostatic potential differences. ↑ AMMETER

NJ096 electrostatic voltmeter (*n.*) Alternative term for ELECTROMETER. ↑ AMMETER

NJ097 hot-wire instrument (*n.*) An instrument based on the expansion of a wire when heated electrically. The expansion is recorded mechanically on a scale, and the scale can be calibrated in amperes or volts, forming an ammeter or a voltmeter. Resistances are connected in parallel, or in series, to convert the basic instrument to an ammeter and a voltmeter respectively. The instruments can be used with both d.c. and a.c. ↑ AMMETER

NJ098 ohmmeter (*n.*) An instrument for

measuring resistance in ohms; it incorporates an electric cell and a circuit, and measures the current passing through the unknown resistance. ↓ DYNAMOMETER · WATTMETER ↑ GALVANOMETER

NJ099 dynamometer (*n.*) An electrical instrument for measuring power. It consists of a coil freely suspended between two fixed coils. With all three coils connected in series, it functions as an ammeter; with the suspended coil connected to a high resistance across the supply, it functions as a wattmeter. ↑ OHMMETER

NJ100 wattmeter (*n.*) A dynamometer connected so as to measure power, with the scale calibrated in watts. ↑ OHMMETER

NJ101 thermoelectricity (*n.*) The study of the phenomenon of electric current produced by the direct transformation of heat energy into electrical energy. —***thermoelectric*** (*adj.*) ↓ SEEBECK EFFECT · THERMOCOUPLE · PELTIER EFFECT ↑ ELECTRICITY

NJ102 Seebeck effect (*n.*) If a circuit is made from two different metals, A and B, joined at their ends, and the two junctions of the metals are maintained at different temperatures, an e.m.f. is produced. This is known as the Seebeck effect. ↓ THERMOELECTRIC EFFECTS · CONTACT E.M.F. · CONTACT P.D. · THERMOELECTRIC E.M.F. · THERMOELECTRIC SERIES ↑ THERMOELECTRICITY

NJ103 thermoelectric effects (*n.pl.*) Phenomena which occur when there are temperature differences in an electrical circuit. They are the **Seebeck effect**, the **Peltier effect**, and the **Kelvin** (or **Thomson**) **effect.** ↑ SEEBECK EFFECT

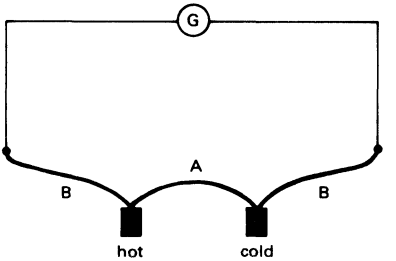
NJ104 contact e.m.f. (*n.*) The e.m.f. which arises when two metals are put in contact. The origin of the e.m.f. is in the migration of free electrons from one metal to another. The contact e.m.f. will vary with temperature as the velocities of the electrons will be increased; in general, the contact e.m.f. will rise with increasing temperature. ↑ SEEBECK EFFECT

NJ105 contact p.d. (*n.*) The measurable potential difference between two metals in contact; it is of the order of 0·2 V. ↑ SEEBECK EFFECT

NJ106 thermoelectric e.m.f. (*n.*) The e.m.f. produced by the Seebeck effect; it is of the order of a few millivolts for temperature differences of up to 100°C. ↑ SEEBECK EFFECT

NJ107 thermoelectric series (*n.*) Metals and alloys can be listed in a series in which the metal earlier in the list becomes positive at the cold junction and drives current towards the metal later in the list. The separation of metals in the list is also an approximate measure of the magnitude of the thermoelectric e.m.f. A part of the series is—antimony ... iron, zinc, copper, ... lead ... nickel ... bismuth. The largest e.m.f. is obtained from an antimony-bismuth thermocouple. ↑ SEEBECK EFFECT

NJ108 thermocouple (*n.*) **1** A pair of junctions, composed of two different metals, with each junction maintained at a different temperature, constitutes a thermocouple; a thermoelectric e.m.f. is produced by the thermocouple. **2** An instrument for measuring temperature; one junction of the thermocouple is kept at a fixed lower temperature, and the other junction is at the point where the temperature is to be measured. A galvanometer in circuit is calibrated to read temperature directly, or else the thermoelectric e.m.f. is measured with a potentiometer. ↓ THERMOPILE[2] ↑ THERMOELECTRICITY



THERMOCOUPLE

NJ109 thermopile[2] (*n.*) A set of thermocouples connected in series and mounted behind a cone. It forms an instrument, a thermopile, for detecting radiant heat, as any heat received produces a thermoelectric current which is detected, or measured, by a sensitive galvanometer. ↑ THERMOCOUPLE → BOLOMETER[2]

NJ110 Peltier effect (*n.*) When an electric current is driven round a circuit consisting of two different metals, heat is evolved at one junction and absorbed at the other junction. This is the Peltier effect. The effect is complementary to the Seebeck effect. Semiconductors exhibit a much greater Peltier effect than metals. ↓ THOMSON EFFECT · KELVIN EFFECT ↑ THERMO-ELECTRICITY

NJ111 Thomson effect (*n.*) A temperature gradient along a metal conductor gives rise to an electrical potential gradient along the conductor. ↑ PELTIER EFFECT

NJ112 Kelvin effect (*n.*) Alternative term for the THOMSON EFFECT. ↑ PELTIER EFFECT

Electromagnetism

NK001 electromagnetism (*n.*) The study of the magnetic effects produced by electric currents and of electric effects produced by magnetic fields. ↓ MAGNETIC FIELD[2] ·

MAGNETIZING FORCE · MOTOR EFFECT · DIAMAGNETIC ↑ ELECTRICITY

NK002 magnetic field[2] (*n.*) A field of force which exists as a result of the presence of a conductor carrying an electric current, or of a permanent magnet. A magnetic field exists at any point if a small coil of wire carrying an electric current experiences a couple, provided its axis is not parallel to the magnetic field's direction. A magnetic field has direction and magnitude (a vector quantity); the magnitude can be measured in two ways, *a* by the flux density which measures the force acting on an electric current in the magnetic field; *b* by the magnetizing force of the field. ↓ LINE OF FORCE · RIGHT-HAND SCREW RULE · FLUX DENSITY[1] · MAGNETIC FLUX DENSITY · MAGNETIC FLUX · FLUX LINKAGE · FLUXMETER ↑ ELECTROMAGNETISM

NK003 line of force (*n.*) **1 Magnetic line of force** An imaginary line drawn in a magnetic field whose direction at every point is the same as the direction of the magnetic field at that point. The direction of the magnetic field is that in which a free north-seeking pole would travel. **2 Electric lines of force** An imaginary line drawn in an electric field whose direction at every point is the same as the direction of the electric field at that point. The direction of the line of force is that of the force which would act on a positive charge at a point. A line of force starts on a positive charge and ends on a negative one. ↑ MAGNETIC FIELD[2]

NK004 right-hand screw rule (*n.*) The direction of lines of force round a current is that in which a right-handed screw would be turned in order to advance the screw in the direction of the current. ↑ MAGNETIC FIELD[2]

NK005 flux density[1] (*n.*) The flux density (*B*) of a magnetic field at a point is the force per unit length that acts on a wire carrying unit electric current, *i.e.* 1 ampere, lying at right angles to the magnetic field. The force, *F*, acting on a wire of length *l*, and carrying a current *I*, is given by:

$$F = BIl$$

The couple, or torque, *T*, acting on a coil of area *A* and *n* turns, carrying a current, *I*, and inclined with the axis of the coil at an angle, φ, to the direction of the magnetic field, is given by:

$$T = BAnI \sin \varphi$$

Flux density is measured in teslas (symbol T) or in webers per square metre (symbol Wb m^{-2}). The magnetic force on a charged particle, carrying a charge, *e*, moving with a velocity, *v*, inclined at an angle θ to the direction of the magnetic field is given by:

$$F = Bev \sin \theta$$

The force is at right angles to the magnetic field and to the path of the particle, and the direction of deflection is given by Fleming's left-hand rule (remembering conventional current flows from positive to negative). ↑ MAGNETIC FIELD[2] → FLEMING'S LEFT-HAND RULE

NK006 magnetic flux density (*n.*) Alternative term for FLUX DENSITY (↑).

NK007 magnetic flux (*n.*) The flux (symbol Φ, the Greek letter phi) of a magnetic field through a small plane surface is the product of the area of the surface and the component of the flux density (*B*) normal to the surface. If the plane is inclined at an angle φ to the direction of the magnetic field, and has an area *A*, then

$$\Phi = BA \sin \varphi$$

↑ MAGNETIC FIELD[2]

NK008 flux linkage (*n.*) A conductor carrying an electric current or a permanent magnet gives rise to a magnetic field; if such a field passes through a coil, the coil has a flux linkage with the magnetic field. If a flux, Φ, threads through a coil of *n* turns, then:

flux linkage = (flux through cross-section of coil) × (no. of turns)

$$= n\Phi$$

The unit of flux is the weber; to contrast the flux linkage with the flux through the coil, **flux linkage** is usually stated in weber-turns. Flux is usually described in terms of motion, although the magnetic field is stationary □ *the flux entering a coil; the flux emerging from a coil; the flux threading through the coil; the flux linking the coils* ↑ MAGNETIC FIELD[2]

NK009 fluxmeter (*n.*) An instrument for measuring magnetic flux. It consists of a ballistic galvanometer connected to a search coil in series with a high resistance (the latter reduces damping). The search coil is put in the magnetic flux and quickly withdrawn, causing a deflection on the galvanometer. The flux density is determined from the area of the coil and the total flux measured. ↑ MAGNETIC FIELD[2]

NK010 magnetizing force (*n.*) The magnetizing force (symbol *H*) at a point in a medium is measured by a couple that would act on a small magnet of unit moment placed at that point with its axis at right angles to the direction of the magnetic field. Magnetizing force is measured in amperes per metre (A m^{-1}). The magnetizing forces of various configurations of current are:

a near a long straight wire, at a distance *r* from the wire:

$$H = \frac{I}{2\pi r}$$

b at the centre of a plane circular coil of radius *r*, and of *n* turns:

$$H = \frac{nI}{2r}$$

c inside a long solenoid with *n* turns of length *l*:

$$H = \frac{nI}{l} = I \times (\text{number of turns per metre})$$

The magnetizing force at a point in a vacuum is equal to the flux density divided by the magnetic space constant (μ_0):

$$H = \frac{B}{\mu_0} \text{ i.e. } B = \mu_0 H.$$

↓ MAGNETIC INTENSITY · MAGNETIC PERMEABILITY · MAGNETIC SPACE CONSTANT ·

RELATIVE PERMEABILITY · AMPERE'S LAW ↑ ELECTROMAGNETISM

NK011 magnetic intensity (*n.*) Alternative term for MAGNETIZING FORCE.

NK012 magnetic permeability (*n.*) A property of a medium which determines the flux density in the medium arising from a magnetizing force. The symbol for permeability is μ (the Greek letter mu). If H is the magnetizing force, and B is the flux density resulting from the magnetizing force, then $B = \mu H$. In a vacuum, the magnetic permeability is the magnetic space constant. In any other medium, the relative magnetic permeability is measured (known as the relative permeability). ↑ MAGNETIZING FORCE

NK013 magnetic space constant (*n.*) The permeability of a vacuum or of free space. It is derived from the expression for the magnetic field of a long straight wire carrying current together with the definition of the ampere. The flux density (B) of a magnetic field at a distance r from a long straight wire carrying a current (I) is given by:

$$B = \frac{\mu I}{2\pi r}$$

where μ is a constant, a property of the medium in which the wire is embedded. For a vacuum, the symbol μ_0 is used. From the definition of the ampere, two conductors, 1 metre apart, have a force between them of 2×10^{-7} N per metre length.

$$F = BIl = \frac{\mu_0 I^2 l}{2\pi r}$$

$$\mu_0 = \frac{2 \times 10^{-7} \times 2\pi \times 1}{I^2 \times 1} = 4\pi \times 10^{-7} \text{ Wb A}^{-1} \text{ m}^{-1}$$

The units are weber per ampere per metre. ↑ MAGNETIZING FORCE

NK014 relative permeability (*n.*) Relative permeability is the ratio of the permeability of a medium (or substance) to the permeability of a vacuum (μ_0); it is given the symbol

$$\mu_r = \frac{\mu}{\mu_0}$$

$$i.e.\ \mu = \mu_r \mu_0$$

The relative permeability of air and most other substances differs only slightly from that of a vacuum; exceptions are the ferromagnetic materials. Relative permeability is a ratio, and, from its measurement, substances are described as diamagnetic or paramagnetic. ↑ MAGNETIZING FORCE

NK015 Ampere's law (*n.*) The magnetic field due to a conductor carrying an electric current is, at any point, proportional to the product of the current and the length of the conductor and inversely proportional to the square of the distance between the conductor and the point. The direction of the magnetic field is perpendicular to the plane containing the point and the conductor. ↑ MAGNETIZING FORCE

NK016 motor effect (*n.*) When a wire carrying an electric current is placed at right angles to a magnetic field, a force acts on it which is perpendicular to both the wire and the magnetic field. ↓ FLEMING'S LEFT-HAND RULE · LEFT-HAND RULE ↑ ELECTROMAGNETISM

NK017 Fleming's left-hand rule (*n.*) If the thumb and the first two fingers of the left hand are put mutually at right angles, and, *a* the first finger points in the direction of a magnetic field; *b* the second finger points in the direction of the electric current; *c* then the thumb points in the direction of the force acting on the conductor. Note: current is conventional, *i.e.* from positive to negative. ↑ MOTOR EFFECT

NK018 left-hand rule (*n.*) Alternative term for FLEMING'S LEFT-HAND RULE.

NK019 diamagnetic (*adj.*) Describes a material, or substance, which has a relative permeability of less than unity. ↓ PARAMAGNETIC · FERROMAGNETIC ↑ ELECTROMAGNETISM

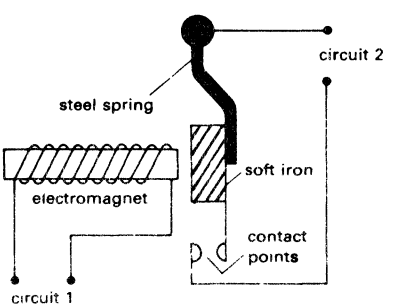
NK020 paramagnetic (*adj.*) Describes a material, or substance, which has a relative permeability greater than unity. ↑ DIAMAGNETIC

NK021 ferromagnetic (*adj.*) Describes a material, or substance, which has a relative permeability very much greater than unity. ↑ DIAMAGNETIC

NK022 electromagnetic (*adj.*) Of or to do with electromagnetism, *e.g.* a microphone is an electromagnetic device for converting sound waves into a varying electric current. ↑ DIAMAGNETIC

NK023 electromagnet (*n.*) A temporary magnet formed by winding a coil of wire round a soft iron core and passing an electric current through the coil. When the current stops, the iron core is no longer magnetized. —*electromagnetic* (*adj.*) ↓ SOLENOID · TELEPHONE · MICROPHONE · CORE[2] ↑ ELECTRICITY

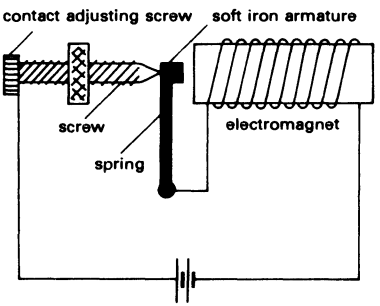
NK024 solenoid (*n.*) A coil of wire wound uniformly on a cylindrical former, such that the length of the coil is much greater than its diameter. When an electric current is passed through the coil, a uniform magnetic field is produced inside the coil, and the coil behaves similarly to a permanent magnet.



RELAY

Putting an iron core in the solenoid increases the strength of the magnetic field. ↓ RELAY · MAKE-AND-BREAK CIRCUIT · ELECTRIC BELL · TELEGRAPH · MORSE CODE · GONG[2] · BUZZER · MORSE ↑ ELECTROMAGNET

NK025 relay (*n.*) A device by which electric current flowing in one circuit can open or close current in a second circuit; the current in the first circuit controls the current in the second circuit. Mechanical relays use a soft iron armature attracted by an electromagnet, and returned by a steel spring. Electronic relays use a thyratron. ↑ SOLENOID → THYRATRON



MAKE-AND-BREAK CIRCUIT

NK026 make-and-break circuit (*n.*) A device which alternately connects and disconnects an electric circuit so that the electric current is started and stopped. It consists of a contact screw against which presses a steel spring which has a soft iron armature attached. An electromagnet attracts the armature, and contact is broken. This breaks the circuit, the electromagnet no longer attracts the armature, the steel spring returns and the circuit is made again. The procedure is repeated indefinitely, resulting in an intermittent current. A make-and-break circuit is used in an electric bell, in an induction coil, and in other devices. ↑ SOLENOID

NK027 electric bell (*n.*) A simple device using a make-and-break circuit to strike a gong. A small hammer is attached to the spring of the circuit, and it vibrates backwards and forwards, striking the gong as it does so. ↑ SOLENOID

NK028 telegraph (*n.*) A tapping key is used to close a circuit to send an electrical impulse along a wire. At the receiving end the impulse operates a relay which closes a circuit carrying a much larger current. This current operates a buzzer, or a telephone receiver. The impulses are long or short, and are used in a code to represent letters or numbers. Long and short impulses are called dashes and dots, and can be recorded on tape. ↑ SOLENOID

NK029 morse code (*n.*) A system of short and long lengths (called dots and dashes) in which each letter of the alphabet and each number has a symbol in dots and dashes. It is used in telegraphy where the length of the sound makes a dot or a dash; some other writing signs also have a code, so a message can be sent by a signal in the code. ↑ SOLENOID

NK030 gong[2] (*n.*) A metal hemisphere which gives a musical note when struck. ↑ SOLENOID

NK031 buzzer (*n.*) A similar device to an electrical bell, but without the hammer and gong. The rapid vibration of the spring gives out a high frequency sound, called buzzing. —***buzzing*** (*n.*) ↑ SOLENOID

NK032 morse (*n.*) Shorter term for MORSE CODE (↑) □ *signals sent in morse by radio waves can be transmitted over long distances* ↑ SOLENOID

NK033 telephone (*n.*) A device in which sound waves are transformed by a microphone to variable electrical impulses, which are transmitted by wires to a receiver. The receiver can be an earphone or a loudspeaker. ↓ TELEPHONE RECEIVER · EARPHONE · MOVING-COIL LOUDSPEAKER · DIAPHRAGM[2] ↑ ELECTROMAGNET

NK034 telephone receiver (*n.*) Alternative term for EARPHONE (↓)

NK035 earphone (*n.*) (Used as a telephone receiver) a device consisting of a permanent magnet with two soft-iron pole pieces. Coils of wire are wound round the magnets, and a current in the coil changes the flux density of the magnetic field. An iron diaphragm is placed above the magnet, and is under tension from the field of the permanent magnet. Electric impulses pass through the coil and cause the diaphragm to vibrate and produce sound waves. One earphone is used with a telephone; two earphones are used with a radio receiver. ↑ TELEPHONE

NK036 moving-coil loudspeaker (*n.*) The construction is very similar to that of a moving-coil microphone. The diaphragm is much larger to produce sounds. ↓ MOVING-COIL MICROPHONE ↑ TELEPHONE

NK037 diaphragm[2] (*n.*) A thin plate of elastic material, *e.g.* metal or rubber, which can vibrate and produce sound waves or which is vibrated by sound waves. ↑ TELEPHONE

NK038 microphone (*n.*) A device for transforming sound energy into electrical energy. The various types are a carbon microphone (mainly used in telephones), a crystal microphone, a condenser microphone, and a moving coil or dynamic microphone (these types are mainly used for radio transmitters). ↓ CARBON MICROPHONE · CONDENSER MICROPHONE · MOVING-COIL MICROPHONE · DYNAMIC MICROPHONE · CRYSTAL MICROPHONE · PIEZO-ELECTRIC EFFECT ↑ ELECTROMAGNET

NK039 carbon microphone (*n.*) This consists of a small box loosely packed with carbon granules. Two carbon blocks are situated in the granules, one being fixed to the back of the box, and the other being fixed to a diaphragm. When the granules are compressed, by vibrations of the dia-

phragm, the resistance between the carbon blocks decreases, and the electric current in the microphone circuit rises. This current is stepped up by a transformer and transmitted by telephone wires. ↑ MICROPHONE

NK040 condenser microphone (*n.*) This consists of an air capacitor with one fixed plate and the other plate attached to a diaphragm. Movements of the diaphragm cause a change in the capacitance of the capacitor, which in turn varies the p.d. between the plates of the capacitor. The p.d. is amplified by a valve. This type of microphone is mainly used in radio transmitters. ↑ MICROPHONE

NK041 moving-coil microphone (*n.*) This consists of a small coil connected directly to the diaphragm, with the coil moving in a strong magnetic field of an annular gap in a circular permanent magnet. When the diaphragm oscillates, the flux through the coil changes and an induced e.m.f. is created. This e.m.f. is amplified by a valve in a radio transmitter. ↑ MICROPHONE

NK042 dynamic microphone (*n.*) Alternative term for a MOVING-COIL MICROPHONE. ↑ MICROPHONE

NK043 crystal microphone (*n.*) Two metal electrodes are placed in contact with a crystal, such as quartz. The crystal is so arranged that incident sound waves produce a piezo-electric effect. ↑ MICROPHONE

NK044 piezo-electric effect (*n.*) An effect produced in certain asymmetric crystals. When pressure is applied to such a crystal, positive and negative charges are produced on opposite faces, giving rise to a p.d. between the faces. The p.d. operates in the opposite direction if a tension is applied instead of a pressure. This p.d. is used in a crystal microphone to produce a varying electrical current for transmission by telephone wires. An inverse piezo-electric effect can be obtained by applying a p.d. to a crystal; an alteration in size of the crystal takes place. ↑ MICROPHONE

NK045 core² (*n.*) The central part of an object; an iron object, whether a bar, a bundle of laminations, or wires, in the middle of a coil, surrounded by the wire of the coil. The coil may be a plane coil, a solenoid, or part of a device such as a transformer. ↓ FORMER · LAMINATION · GEOMETRY · AMPERE-TURN ↑ ELECTROMAGNET

NK046 former (*n.*) A piece of non-conducting material, round which a coil is wound, to give the coil of wire a definite geometric shape. Resistance wire can also be wound round a former to form a resistor, and to keep the wire from touching along its length. ↑ CORE²

NK047 lamination (*n.*) A thin sheet of iron used in iron-cored apparatus; a bundle of laminations is used to form the core. The loss of energy through eddy currents is approximately proportional to the square of the thickness of a lamination; for low frequency variations of magnetic flux, laminations of about 0·5 mm thickness are used; for higher frequencies, a bundle of iron wires is used; for radio frequencies, even laminations are not satisfactory. ↑ CORE²

NK048 geometry (*n.*) The geometry of a device, particularly a coil or any electrical device depending upon induction, is the shape of its working part; for a device involving two working parts, such as two coils, it includes the arrangement of the parts in space. An inductive effect is thus determined by the geometry of an electrical device. ↑ CORE²

NK049 ampere-turn (*n.*) The unit of measurement for the strength of an electromagnet; the number of turns per metre multiplied by the current in amperes gives the strength of the electromagnet. ↑ CORE²

NK050 electromagnetic induction (*n.*) When the magnetic flux linked with an electrical circuit changes, an e.m.f. is induced in the circuit. An induced current flows in the circuit, depending on the induced e.m.f. and the resistance of the circuit. The magnitude and direction of the induced e.m.f. is described by Faraday's law and Lenz's law. Electromagnetic induction is the basis of the dynamo, transformer, induction coil, and the cause of inductance, eddy currents, etc. ↓ INDUCED E.M.F · EDDY CURRENT · SELF-INDUCTION · TRANSFORMER · INDUCTIVE ↑ ELECTRICITY

NK051 induced e.m.f. (*n.*) See ELECTROMAGNETIC INDUCTION. ↓ FARADAY'S LAW · LENZ'S LAW · NEUMANN'S LAW · FLEMING'S RIGHT-HAND RULE · RIGHT-HAND RULE ↑ ELECTROMAGNETIC INDUCTION

NK052 Faraday's law (*n.*) When the flux linkage of a magnetic field with a circuit changes, an e.m.f. is induced which is proportional to the rate of change of flux linkage. ↑ INDUCED E.M.F.

NK053 Lenz's law (*n.*) When the flux linkage of a magnetic field with an electrical circuit is changing, the direction of the induced e.m.f. is such that the effects of any current it produces tend to oppose the change of flux. (The induced current flows in such a direction that its magnetic field tends to neutralize the change in magnetic flux.) ↑ INDUCED E.M.F.

NK054 Neumann's law (*n.*) If the magnetic flux linked with an electrical circuit is Φ, then the rate of change of magnetic flux is $d\Phi/dt$ and the induced e.m.f. (E) is given by:

$$E = -\frac{d\Phi}{dt}$$

↑ INDUCED E.M.F.

NK055 Fleming's right-hand rule (*n.*) If the thumb and first two fingers of the right hand are put mutually at right angles, and, ***a*** the first finger is pointed in the direction of the magnetic field; ***b*** the thumb is in the direction of motion of the conductor; ***c*** then the second finger gives the direction of the induced current. Note: conventional current, from positive to negative, is described. ↑ INDUCED E.M.F.

NK056 right-hand rule (*n.*) Alternative term for FLEMING'S RIGHT-HAND RULE (↑).

NK057 eddy current (*n.*) When a conductor moves in a magnetic field, it cuts the magnetic flux, and the changing magnetic flux induces an e.m.f. A piece of metal swinging between the poles of a magnet fulfils these conditions, and the induced e.m.f. forms eddy currents which circulate in the metal. By Lenz's law, these eddy currents flow in a direction to oppose the motion of the piece of metal. Eddy currents cause electromagnetic damping, and the piece of metal rapidly comes to rest. Eddy currents are suppressed by laminations in iron-cored apparatus, such as electric motors, dynamos, transformers, etc. Eddy currents set up in iron-cored apparatus cause considerable waste of energy, dissipated as heat. ↓ INDUCTION HEATING · INDUCTION MOTOR · SQUIRREL-CAGE · BACK E.M.F. ↑ ELECTROMAGNETIC INDUCTION

NK058 induction heating (*n.*) The process in which a material, which must be electrically conducting, is subjected to an alternating magnetic field; induced currents in the material heat it. ↑ EDDY CURRENT

NK059 induction motor (*n.*) A type of electric motor in which an alternating current is fed to the field coils, and the rotor consists of copper bars welded to copper rings at both ends of the bars. The rotor has a laminated iron core. The field coils produce a rotating magnetic field which induces current in the copper bars. The magnetic field causes the rotor to turn faster until the rotor and the magnetic field rotate at the same speed. At such a rate of rotation, no current would be induced in the rotor and the rotor therefore slips behind the field; the greater the load, the greater the degree of slip. ↑ EDDY CURRENT

NK060 squirrel-cage (*n.*) The term used to describe the arrangement of copper bars in the rotor of an induction motor. ↑ EDDY CURRENT

NK061 back e.m.f. (*n.*) When the armature of an electric motor rotates, an e.m.f. is induced in the coil by the magnetic field of the field coils. This e.m.f. is in opposition to the e.m.f. supplied to the armature; it is a back e.m.f. ↑ EDDY CURRENT

NK062 self-induction (*n.*) An effect in which a changing current in an electrical circuit causes an induced e.m.f. The changing electric current gives rise to a changing magnetic flux which threads through the circuit, and induces an e.m.f. The self-induced e.m.f. opposes the change in current. Thus, when a d.c. circuit is switched on, the induced e.m.f. delays the growth of the current to its maximum value with a large coil possessing an iron core; this may take several seconds. The opposite effect occurs when switching off a circuit. ↓ MUTUAL INDUCTION · SELF-INDUCTANCE · INDUCTANCE · MUTUAL INDUCTANCE · INDUCTOR · INDUCTOMETER · CHOKE ↑ ELECTROMAGNETIC INDUCTION

NK063 mutual induction (*n.*) An effect in which the induction of an e.m.f. in an electrical circuit is caused by a changing current in a second circuit; the two circuits are linked by a magnetic flux, but are not connected electrically. ↑ SELF-INDUCTION

NK064 self-inductance (*n.*) The measurement of the effect of self-induction. The self-induced e.m.f., E, in a coil, with an air core, is proportional to the rate of change of current in the coil:

$$E \propto -\frac{dI}{dt}$$

$$E = L\frac{dI}{dt}$$

where L is a constant depending on the geometry of the coil. L is called the self-inductance, and is measured in henrys. ↑ SELF-INDUCTION

NK065 inductance (*n.*) A term often used in place of SELF-INDUCTANCE. ↑ SELF-INDUCTION

NK066 mutual inductance (*n.*) The measurement of the mutual induction effect. The e.m.f. (E) induced in a coil by the magnetic field due to another coil is proportional to the rate of change of current in the latter coil (provided both coils are air-cored):

$$E \propto -\frac{dI}{dt}$$

$$E = M\frac{dI}{dt}$$

where M is a constant for the two coils. M is called the mutual inductance, and is measured in henrys. ↑ SELF-INDUCTION

NK067 inductor (*n.*) A component of an electrical circuit with a self-inductance or a mutual inductance. ↑ SELF-INDUCTION

NK068 inductometer (*n.*) An inductor with a calibrated, variable inductance. ↑ SELF-INDUCTION

NK069 choke (*n.*) A coil with a low resistance and a high self-inductance; it can have an air core or an iron core. It allows direct current to pass, but suppresses alternating current. ↑ SELF-INDUCTION

NK070 transformer (*n.*) A device which uses the principle of mutual induction to alter the voltage of alternating current. It consists of a **primary coil** wound on a soft iron core and a **secondary coil** wound on the same iron core. An alternating current in the primary coil produces a changing magnetic flux; the primary coil and the secondary coil are linked by this flux, so an e.m.f. is induced in the secondary coil. The iron core is a closed loop, to ensure all the energy in the primary coil is transferred to the secondary coil; this is essential for currents alternating at low frequencies. The iron core is laminated to prevent heat losses from eddy currents. ↓ PRIMARY · SECONDARY · TURNS RATIO · INDUCTION COIL · COIL IGNITION

· COPPER LOSSES · IRON LOSSES ↑ ELECTROMAGNETIC INDUCTION

NK071 primary (*n.*) Alternative term for the PRIMARY COIL (↑) in a transformer or induction coil, or in any circuit which is magnetically linked with a secondary circuit, and forms the input circuit. ↑ TRANSFORMER

NK072 secondary (*n.*) Alternative term for the SECONDARY COIL (↑) in a transformer or in an induction coil, or in any circuit which is magnetically linked with a primary circuit. ↑ TRANSFORMER

NK073 turns ratio (*n.*) The ratio of the number of turns in a secondary coil to the number of turns in a primary coil in a transformer. The ratio of the secondary p.d. to the primary p.d. is equal to the turns ratio, or very nearly so; most transformers are more than 99% efficient, *i.e.* the loss from the secondary p.d. is less than 1%:

$$\text{turns ratio} = \frac{\text{number of turns in secondary}}{\text{number of turns in primary}} = \frac{\text{secondary p.d.}}{\text{primary p.d.}}.$$

The symbol for turns ratio is T, for number of turns in the primary n_p and in the secondary n_s.

$$T = \frac{n_s}{n_p}.$$

↑ TRANSFORMER

NK074 induction coil (*n.*) A device for producing a rapid succession of large pulses of e.m.f. from a supply of low e.m.f. It consists of a primary coil and a secondary coil wound on a laminated soft iron core. The primary circuit consists of a battery of electric cells, a make-and-break device, and the primary coil. The make-and-break circuit produces a fluctuating current which induces a large e.m.f. in the secondary coil. The self-inductance of the primary coil, coupled with the mutual inductance of the secondary coil, produces an e.m.f. with a large pulse almost entirely in one direction. Potential differences of up to 100 kV can be obtained from an induction coil. ↑ TRANSFORMER

NK075 coil ignition (*n.*) An induction coil with the make-and-break circuit operated by a rotating cam. The spark supplied by the coil is used to operate a sparking plug in an internal combustion engine. ↑ TRANSFORMER

NK076 copper losses (*n.pl.*) The ordinary heat losses that arise in a coil on account of its resistance; used to describe energy losses in transformers and other inductive devices. ↑ TRANSFORMER

NK077 iron losses (*n.pl.*) Energy losses that arise in the iron core of a transformer or other inductive device. They are caused by, *a* eddy currents producing heat which is dissipated; *b* hysteresis causing energy to be dissipated in reversing the magnetization of the core – this energy is also dissipated as heat in the iron core. ↑ TRANSFORMER

NK078 inductive (*adj.*) Describes an electrical circuit in which induction, either self-induction or mutual induction, can occur, *e.g.* a resistor wound in the form of a coil is inductive, as self-induction takes place on switching d.c. on or off, or on passing a.c. The circuit, or component, has the disposition to exhibit induction. ↓ INDUCED · STEP-UP · STEP-DOWN · TAPPED ↑ ELECTROMAGNETIC INDUCTION

NK079 induced (*adj.*) Describes an e.m.f., or a current, caused by induction; in inductive circuits, the e.m.f. or current can be self-induced or mutually induced. ↑ INDUCTIVE

NK080 step-up (*adj.*) Describes a transformer in which the secondary p.d. is higher than the primary p.d. The voltage is said to be **stepped up.** —***step up*** (*v.*) ↑ INDUCTIVE

NK081 step-down (*adj.*) Describes a transformer in which the secondary p.d. is lower than the primary p.d. The input voltage is said to be **stepped down.** —***step down*** (*v.*) ↑ INDUCTIVE

NK082 tapped (*adj.*) Describes a coil, or a resistor, or any electrical circuit, which has a connection at a point other than that for a normal connection, *e.g.* a connection made in the middle of a coil (a centre-tapped coil). A transformer can be tapped on the secondary so that a voltage lower than that provided by the whole secondary coil can be obtained. The primary of a transformer can also be tapped so that inputs with different p.d.s can be used. ↑ INDUCTIVE

NK083 generator[1] (*n.*) A device for transforming mechanical energy into either electric current (electromagnetic generator) or high electric potential (electrostatic generator). ↓ DYNAMO · ARMATURE · SERIES WOUND ↑ ELECTRICITY → ELECTROSTATIC GENERATOR

NK084 dynamo (*n.*) A machine for producing electrical energy from mechanical energy. A set of coils is rotated in a magnetic field; the changing flux induces an e.m.f. which constitutes the electrical supply. A dynamo can produce either d.c. or a.c. depending on its design. The current induced in the coils is a.c. The structure of a dynamo is identical in principle with an electric motor. If the motor is supplied with electrical energy it produces mechanical energy. ↓ DIRECT-CURRENT GENERATOR · ALTERNATING-CURRENT GENERATOR · ALTERNATOR · INDUCTION GENERATOR · MAGNETO ↑ GENERATOR[1]

NK085 direct-current generator (*n.*) A generator in which the armature coils are connected to a commutator; d.c. is produced. ↑ DYNAMO

NK086 alternating current generator (*n.*) There are two types of a.c. generator; a synchronous generator (alternator) and an induction generator. ↑ DYNAMO

NK087 alternator (*n.*) A generator in which the armature coils are connected to slip rings; a.c. is produced which is synchronous with the rotor (a synchronous a.c. generator). ↑ DYNAMO

NK088 induction generator (*n.*) An

induction motor operated as an a.c. generator. ↑ DYNAMO

NK089 magneto (*n.*) A small dynamo, connected to a spark coil, which provides, through a distributor, sparks to the cylinder of a petrol engine for igniting the petrol vapour. ↑ DYNAMO

NK090 armature (*n.*) **1** The coil, or coils, together with an iron core, usually rotating, driven by a shaft in a generator. **2** The coil or coils, together with an iron shaft, through which an electric current is passed causing the armature to rotate in an electric motor. **3** Any part of an electrical device or apparatus in which an e.m.f. is induced by a magnetic field, or which is attracted by a magnetic field. An armature is made of soft iron so no magnetism is retained. ↓ FIELD COIL · SLIP RINGS · COMMUTATOR · BRUSHES · WINDING ↑ GENERATOR[1]

NK091 field coil (*n.*) A coil forming an electromagnet in an electric motor or generator. Simple motors or generators have permanent magnets; heavy duty motors and generators have field coils. ↑ ARMATURE

NK092 slip-rings (*n.pl.*) Two insulated copper rings on the driving shaft of the armature of an electric motor or generator. The ends of the armature coils are connected to the slip-rings so that there is a circuit from one slip-ring, through the coil, to the other slip-ring. The a.c. generated in the coil is supplied to the slip-rings. ↑ ARMATURE

NK093 commutator (*n.*) A device for reversing the direction of an electric current. In a dynamo it consists of a copper ring, divided into segments, mounted on the driving shaft of the armature. Each coil of the armature is connected to two segments diametrically opposed on the shaft. As the shaft rotates, brushes make contact with the segments, and the connection is reversed every half turn of the shaft. The a.c. induced in the coil is reversed and a fluctuating direct current is formed. ↑ ARMATURE

NK094 brushes (*n.pl.*) Fixed conductors, usually graphite blocks pressed by springs against a slip-ring or a commutator. They lead current away from the slip-ring or commutator to the external circuit. ↑ ARMATURE

NK095 winding (*n.*) **1** The action of making a coil on a former. **2** The coil made as a result of this, *e.g.* the winding on an armature is the coil wound on the armature. —***wind*** (*v.*) WOUND (*adj.*) ↑ ARMATURE

NK096 series-wound (*adj.*) Describes an electric motor or a generator in which the field coils are connected in series with the armature. ↓ SHUNT-WOUND · COMPOUND-WOUND ↑ GENERATOR[1]

NK097 shunt-wound (*adj.*) Describes an electric motor or a generator in which the field coils are connected in parallel with the armature. ↑ SERIES-WOUND

NK098 compound-wound (*adj.*) Describes an electric motor, or a generator, in which the field coils carry two windings, a series winding of a few turns of thick wire and a shunt winding of many turns of finer wire. ↑ SERIES-WOUND

NK099 mains (*n.pl.*) The cables supplying electric current to a house or factory. There are two mains, one is live and the other is neutral. The supply is alternating current in most countries; in some countries there are three mains, the third one being earthed □ *mains electricity* ↓ CABLE[2] · INPUT · RECTIFICATION · ELECTRICAL APPLIANCE · LIVE[2] · THREE-PHASE ↑ ELECTRICITY

NK100 cable[2] (*n.*) A conductor for a high electric current; it consists of several wires twisted together and covered with insulating material such as rubber, plastic, or cloth. ↓ COAXIAL CABLE · POWER STATION · GRID[1] · PHASE SPLITTING ↑ MAINS

NK101 coaxial cable (*n.*) A cable with a central conducting core, either a wire or wires twisted together, with a concentric conducting cylinder; in between the two conductors is a sheath of a dielectric, or insulating substance, *e.g.* a plastic. Such cables are used for the transmission of high frequency a.c. The outer conductor is usually earthed; the cable transmits electric currents with minimum dissipation of electrical energy. ↑ CABLE[2]

NK102 power station (*n.*) A building containing a generator and the machinery to drive the generator; the machinery can be steam driven, or can be driven by water power (hydro-electric power). The power station supplies electric current to the grid system at 11 kV. ↑ CABLE[2]

NK103 grid[1] (*n.*) The system for conducting electric current by cables, either overhead or underground, from a power station to all parts of a country. The main grid system is at a high voltage (usually 275 kV). Transformers in sub-stations step down the voltage, and secondary grids use lower voltages. The supply is finally delivered to houses, factories, etc., at around 220 V, or in some countries 110 V □ *an electric current is fed into the grid system* ↑ CABLE[2]

NK104 phase splitting (*n.*) The method of generating alternating current from a generator in which the stator is split into separate coils. The number of coils determines the number of phases. Three-phase splitting is the most common, used in almost all power stations. ↓ THREE-PHASE ↑ CABLE[2]

NK105 input (*n.*) The power, or energy, put into a machine or an electrical circuit. ↓ OUTPUT · WATTAGE · POWER FACTOR · RING CIRCUIT ↑ MAINS

NK106 output (*n.*) The power, or energy obtained from a machine or an electrical circuit. ↑ INPUT

NK107 wattage (*n.*) The power of an electrical device, measured in watts. ↑ INPUT

NK108 power factor (*n.*) In an electrical circuit conducting alternating current

$$\text{power factor} = \frac{\text{true power}}{\text{apparent power}}$$

If V and I are the r.m.s. values of p.d. and current in the circuit, then VI is the appa-

rent power. If φ (Greek letter phi) is the phase difference between the current and the p.d., then $VI \cos \varphi$ is the true power of the circuit.

$$\text{power factor} = \frac{VI \cos \varphi}{VI} = \cos \varphi$$

↑ INI

NK109 ring circuit (*n.*) A supply circuit used in domestic electrical supplies. Two wires each form a closed continuous circuit serving all parts of a house. A domestic appliance is connected to the two wires, through a plug, socket, and switch. ↑ INPUT

NK110 rectification (*n.*) The transformation of alternating current to direct current. ↓ HALF-WAVE RECTIFICATION · FULL-WAVE RECTIFICATION · RECTIFIER · METAL RECTIFIER · POWER PACK · INVERTER · RIPPLE ↑ MAINS

NK111 half-wave rectification (*n.*) Only half the cycle of alternating current flows, the other half is suppressed. The result is a series of current impulses. ↑ RECTIFICATION

NK112 full-wave rectification (*n.*) Both halves of the cycle of alternating current are rectified, *i.e.* flow in the same direction. Instead of alternate positive and negative peak values of current, a series of peak values, either positive or negative, is obtained. ↑ RECTIFICATION

NK113 rectifier (*n.*) A device for transforming alternating current to direct current. —***rectify*** (*v.*) ***rectifying*** (*adj.*) ↑ RECTIFICATION → RECTIFYING VALUE · BARRIER-LAYER RECTIFIER · JUNCTION RECTIFIER · CRYSTAL RECTIFIER

NK114 metal rectifier (*n.*) A metal rectifier uses a contact between a metal and another substance. Common types are, *a* copper and copper (I) oxide; *b* iron and selenium; *c* any metal and silicon. The contact allows electric current to flow in one direction only. A single rectifier gives half-wave rectification. Four rectifiers, suitably connected, give full-wave rectification. ↑ RECTIFICATION

NK115 power pack (*n.*) A device with alternating current fed into the input, leading to a circuit with a transformer, rectifiers, capacitor, and resistor; the output supplies direct current with voltages in the range 100 V – 1 kV. ↑ RECTIFICATION

NK116 inverter (*n.*) Any device for converting direct current into alternating current. ↑ RECTIFICATION

NK117 ripple (*n.*) A very small fluctuation in the p.d. supplied by a dynamo; the greater the number of separate coils on the rotor, the smaller the ripple. Ripple is removed by a choke with a high inductance and a low resistance. Ripple is also formed in a rectification circuit. ↓ SMOOTHING ↑ RECTIFICATION

NK118 electrical appliance (*n.*) Any device which uses electrical energy and transforms it to heat or mechanical power, *e.g.* electric cookers, electric fires, electric irons, etc. □ *an appliance consumes electric power* ↓ THREE-PIN PLUG ↑ MAINS

NK119 three-pin plug (*n.*) A plug for connecting electrical appliances to the mains circuit in the house. One pin connects the live wire, and one pin the neutral wire of the mains supply, and the third pin makes an earthed connection, so that any short-circuit in the appliance is immediately earthed. ↑ ELECTRICAL APPLIANCE

NK120 live² (*adj.*) Describes a conductor at a potential greater than that of the earth, so that a connection to earth short circuits the conductor. The term implies it is dangerous to touch the conductor; the result would be a shock, possibly fatal. ↓ NEUTRAL² · EARTHED · WATTLESS · IN QUADRATURE ↑ MAINS

NK121 neutral² (*adj.*) Describes a conductor at a potential the same as that of the earth; or a conductor having neither a net positive nor a net negative charge. ↑ LIVE²

NK122 earthed (*adj.*) Describes a conductor, component, part of a component, or circuit, connected to the earth so that any electric charge is immediately conducted to earth. —EARTH (*v.*) ↑ LIVE²

NK123 wattless (*adj.*) Describes an alternating current or the reactive component of an alternating current in which the power factor is zero, *i.e.* the phase difference between current and p.d. is 90°. ↑ LIVE²

NK124 in quadrature (*adj.*) Describes an alternating current in which the phase difference is 90° between current and p.d. ↑ LIVE²

NK125 three-phase (*adj.*) Describes a system in which alternating current is generated, transmitted, and consumed in three separate circuits. The stator in the generator consists of three separate coils, and the rotor sweeps past each in succession. The a.c. generated in the three circuits has a phase difference of 120°. The three circuits have a common return wire, and if the amplitude in the three output wires is equal, the current in the return wire is zero. ↓ TWO-PHASE · SMOOTHING ↑ MAINS

NK126 two-phase (*adj.*) Describes a system in which alternating current is supplied in two separate circuits from the same generator. The stator consists of two separate coils, and the a.c. generated has a phase difference of 180° in the two circuits. Transmission is the same as for three-phase systems. ↑ THREE-PHASE

NK127 smoothing (*adj.*) Describes the effect of removing ripple from a d.c. circuit; a smoothing circuit is used in a power pack. ↑ THREE-PHASE · RIPPLE →SMOOTHING CIRCUIT

Electronics

NL001 electronics (*n.*) The study of the motion of free electrons and of electrons in motion in electrical circuits; it includes the study of thermionic valves, semiconductors,

photocells, and cathode-ray tubes. —***electronic*** (*adj.*) ↓ THERMIONIC EFFECT · SPACE-CHARGE · THERMIONIC VALVE · GRID[2] · CHARACTERISTICS · AMPLIFIER[1] · LIMITED · REACTANCE · PHOTO-ELECTRIC EFFECT → RADIO · SEMICONDUCTOR · TRANSISTOR · COMPUTER · ELECTRICITY

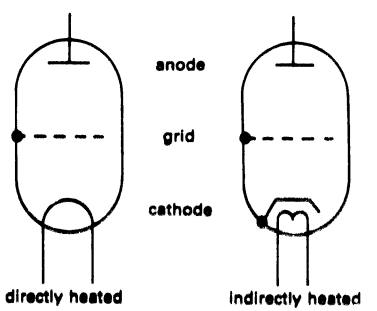
NL002 thermionic effect (*n.*) When a piece of metal is heated to a high temperature, it loses negative charge and becomes positively charged; this is the thermionic effect. ↓ THERMIONIC EMISSION · SPACE-CHARGE · SECONDARY EMISSION · THERMION ↑ ELECTRONICS

NL003 thermionic emission (*n.*) The emission of electrons from a hot metal; thermionic emission is used in thermionic valves, in cathode-ray tubes, X-ray tubes, electron guns, and in discharge tubes. ↑ THERMIONIC EFFECT

NL004 space-charge (*n.*) Electrons are emitted with small velocities from a heated filament; they form a stationary cloud of negative charge, called a space-charge. In a thermionic valve, electrons from the space-charge may return to the cathode, or may be attracted to the anode, depending upon the magnitude of the positive potential of the anode. ↑ THERMIONIC EFFECT

NL005 secondary emission (*n.*) The emission of electrons from a metal when it is bombarded by a stream of electrons. Electrons emitted from the cathode of a thermionic tube hit the anode plate (made of metal). If the velocity of the electrons is sufficiently high, they eject other electrons from the anode. This effect is secondary emission. ↑ THERMIONIC EFFECT

NL006 thermion (*n.*) A term formerly used to describe electric charge emitted from a hot metal; thermions from hot metals are electrons. —***thermionic*** (*adj.*) ↑ THERMIONIC EFFECT



THERMIONIC VALVES

NL007 thermionic valve (*n.*) A device using thermionic emission; it consists of a set of electrodes sealed in an evacuated glass or metal container; a gas at low pressure may be used in the container. The electrodes are, *a* a cathode, heated to emit electrons; *b* an anode, at a positive potential with respect to the cathode, to attract electrons, *c* one or more perforated electrodes, called grids. The cathode can be, *a* directly heated, *i.e.* a filament heated by the passage of an electric current, and acting also as a cathode; *b* a metal cathode, heated indirectly by a separate filament. For circuit symbols, see diagram. Thermionic valves are described as diodes, triodes, tetrodes, or pentodes, depending on the number of electrodes they possess. ↓ DIODE[1] · DOUBLE-DIODE · TRIODE · TETRODE · PENTODE · VALVE[2] · THERMIONIC TUBE · ELECTRONIC VACUUM TUBE ↑ ELECTRONICS

NL008 diode[1] (*n.*) A thermionic valve containing a cathode and an anode only; used in half-wave rectification. ↑ THERMIONIC VALVE

NL009 double-diode (*n.*) A diode with two anode plates; used in full-wave rectification. ↑ THERMIONIC VALVE

NL010 triode (*n.*) A thermionic valve containing an anode, a grid, and a cathode, *i.e.* three electrodes. The basic function of a triode is the amplification of current, voltage, or power. ↑ THERMIONIC VALVE

NL011 tetrode (*n.*) A thermionic valve containing an anode, a control grid, a cathode, and a screen grid between the anode and the control grid. It is a triode with a screen grid added to reduce the capacitance between the control grid and the anode. ↑ THERMIONIC VALVE

NL012 pentode (*n.*) A thermionic valve containing an anode, screen grid, control grid, cathode, and a suppressor grid between the anode and the screen grid. Its function is to reduce the secondary emission of electrons emitted by the anode; it is usually connected directly to the cathode. Pentodes are mainly used for power amplification. ↑ THERMIONIC VALVE

NL013 valve[2] (*n.*) Alternative term for THERMIONIC VALVE (↑).

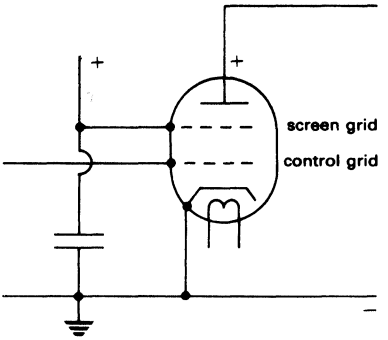
NL014 thermionic tube (*n.*) Alternative term for THERMIONIC VALVE (↑).

NL015 electronic vacuum tube (*n.*) Alternative term for THERMIONIC VALVE (↑).

NL016 grid[2] (*n.*) An electrode in a thermionic valve placed between the anode and the cathode; it is usually perforated, or made of wire, so that electrons can readily pass through it. The grid is used to control the flow of electrons. ↓ CONTROL GRID · SCREEN GRID · SUPPRESSOR GRID · GRID BIAS · GRID LEAK ↑ ELECTRONICS

NL017 control grid (*n.*) A grid in a thermionic valve; it controls the passage of electrons between the cathode and the anode. The greater the negative potential of the grid, the greater the positive potential of the anode to maintain the same flow of electrons, *i.e.* to maintain the same anode current. ↑ GRID[2]

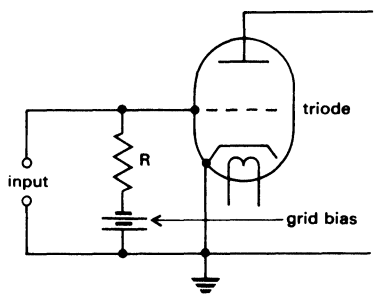
NL018 screen grid (*n.*) A grid placed between the anode and the control grid; it is maintained at a fixed positive potential, slightly less than the positive potential of the anode. Its function is to reduce capacitance between the anode and the control grid; this makes it useful for amplification of radio-



SCREEN GRID

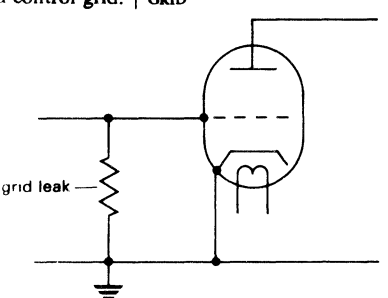
frequency a.c., *i.e.* more efficient for high-frequency applications. The grid is usually connected to earth by a capacitor. ↑ GRID[2]

NL019 suppressor grid (*n.*) A grid placed between the anode and the screen grid in a pentode valve. It is often connected to the cathode. The suppressor grid reduces the secondary electrons emitted by the anode. ↑ GRID[2]



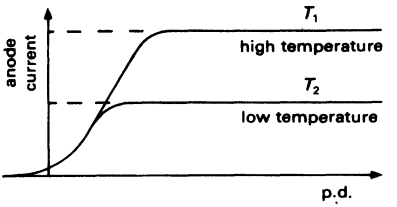
GRID BIAS

NL020 grid bias (*n.*) A fixed voltage applied to make the grid at a negative potential compared to the cathode. An alternating or fluctuating, p.d. applied at the input operates the valve under conditions determined by the grid bias, which ensures the average p.d. of the grid, with reference to the cathode, is negative. A grid bias is applied to a control grid. ↑ GRID[2]

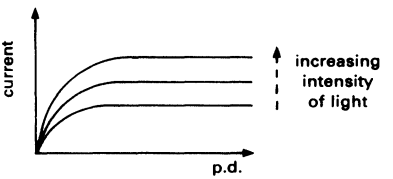


GRID LEAK

NL021 grid leak (*n.*) A resistor of high resistance connecting the grid of a thermionic valve to earth; this prevents the grid from gradually gaining an electric charge. ↑ GRID[2]



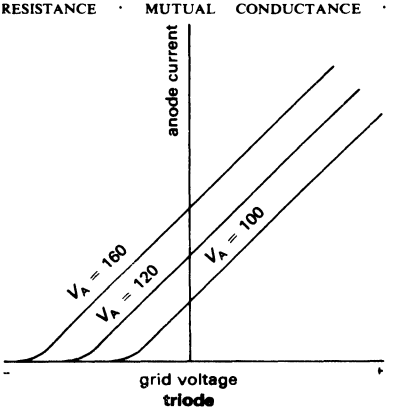
diode



photocell

CHARACTERISTICS OF ELECTRONIC DEVICES

NL022 characteristics (*n.pl.*) Curves obtained by plotting electric current against voltage for electronic devices. There are characteristics for diodes, triodes, photocells, Geiger tubes, etc. ↓ MUTUAL CHARACTERISTICS · DYNAMIC CHARACTERISTICS · SATURATION CURRENT · SATURATION ANODE POTENTIAL · ANODE LOAD · ANODE SLOPE RESISTANCE · MUTUAL CONDUCTANCE ·

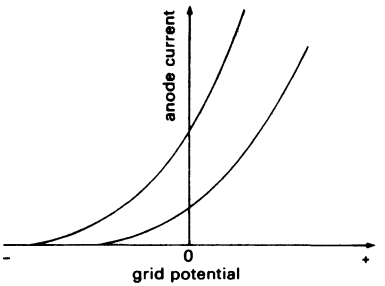


triode

MUTUAL CHARACTERISTICS

TRANSCONDUCTANCE ↑ ELECTRONICS

NL023 mutual characteristics (*n.*) The characteristics of a thermionic tube, other than a diode, under static conditions, *i.e.* without a working load. These are the characteristics usually given for a thermionic valve. ↑ CHARACTERISTICS



DYNAMIC CHARACTERISTICS

NL024 dynamic characteristics (*n.*) The characteristics of a thermionic valve, other than a diode, under working conditions. An anode load has the anode current passing through it; when a change in grid potential alters the anode current this alters the anode potential, as it reduces the p.d. supplied by the H.T. supply. The shape of the characteristics differ as shown in the diagram. ↑ CHARACTERISTICS

NL025 saturation current (*n.*) The current flowing in a thermionic valve when all electrons emitted by the cathode reach the anode. Any increase in anode potential has no further effect on the saturation current. For each temperature of the cathode there is a definite saturation current; saturation current increases with rising temperatures. ↑ CHARACTERISTICS

NL026 saturation anode potential (*n.*) The minimum potential at which the saturation current flows in a diode. ↑ CHARACTERISTICS

NL027 anode load (*n.*) A resistor, or an inductor, connected into the anode circuit of a thermionic valve. Variations in the anode current produce variations in the p.d. across the anode load. ↑ CHARACTERISTICS

NL028 anode slope resistance (*n.*) The internal resistance of a thermionic valve. The symbol for anode slope resistance is R_a.

$$R_a = \frac{\Delta V_a}{\Delta I_a}$$

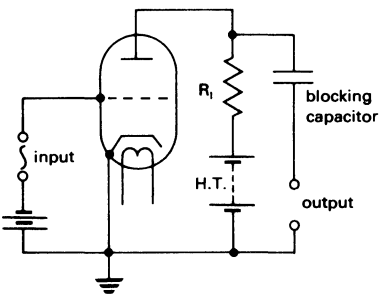
where ΔV_a is a small change in anode potential, and ΔI_a is the corresponding change in anode current. Anode slope resistance is not a constant; its magnitude depends on the anode potential. ↑ CHARACTERISTICS

NL029 mutual conductance (*n.*) **1** The increase in anode current caused by a change of 1 volt in the grid potential. **2** The ratio of the change of anode current to the change in grid voltage, when a small change is made in the grid voltage. ↑ CHARACTERISTICS

NL030 transconductance (*n.*) The increase in current in one part of a circuit per unit increase in e.m.f., or in p.d., in some other part of the circuit, *e.g.* the increase in current in one stage of amplification for a unit increase in p.d. in a previous stage. Mutual conductance is a particular example of transconductance. ↑ CHARACTERISTICS · MUTUAL CONDUCTANCE (H)

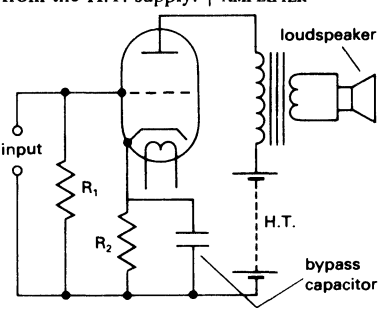
NL031 amplifier[1] (*n.*) An electronic circuit containing thermionic valves, or transistors, which increases the voltage of a signal fed into it by obtaining power from an external supply. —***amplification*** (*n.*) AMPLIFY (*v.*) ↓ VOLTAGE AMPLIFIER · POWER AMPLIFIER · AMPLIFICATION FACTOR[1] · RECTIFYING VALVE · THYRATRON ↑ ELECTRONICS → COMMON-BASE CIRCUIT

NL032 voltage amplifier (*n.*) A single-stage voltage amplifier is shown in the diagram. The alternating p.d., fed in at the input, changes the anode current. The anode current passes through the anode load resistor (R_l) and the p.d. across the resistor changes.



VOLTAGE AMPLIFIER

Let an input signal increase the grid potential by 0·5 V (grid becomes more positive); under the conditions of working this increases the anode current by 1 mA. If the anode load resistor has a resistance of 20 kΩ, the p.d. across it increases by 20 V. The p.d. supplied to the output decreases by 20 V, *i.e.* the amplification is negative. The blocking capacitor filters out the d.c. from the H.T. supply. ↑ AMPLIFIER[1]



POWER AMPLIFIER

NL033 power amplifier (*n.*) A circuit for a power amplifier is shown in the diagram. The anode load is the primary of a transformer; the valve passes relatively large currents. The grid bias is supplied by a bias resistor (R_2) through which the anode current flows. No current flows through R_1 when there is no input, so the bias resistor supplies the p.d. to the control grid. The bypass capacitor prevents the grid bias fluc-

tuating with the anode current, as the a.c. component of the anode current is by-passed through the capacitor; it has a large capacitance. ↑ AMPLIFIER[1]

NL034 amplification factor[1] (*n.*) In a thermionic valve, the amplification factor is the ratio of the anode potential required to cause a small change in current to the grid potential change to cause the same change of current. The amplification factor is given the symbol μ (the Greek letter mu):

$$\mu = \frac{\Delta V_a}{\Delta V_g}$$

where V_a is anode potential and V_g is grid potential. The value of μ depends upon the actual grid and anode potential, and varies with these potentials. The factor is negative as a small positive increase in grid potential produces a large positive decrease in anode potential in the normal amplifying circuit. A triode has a voltage amplification factor of approximately 3 to 100 and a tetrode of approximately 300 to 800. ↑ AMPLIFIER[1]

NL035 rectifying valve (*n.*) A thermionic valve used as a rectifier; normally a diode is used. The diode only passes current when the anode is at a positive potential with respect to the anode. If an alternating current is passed through the diode, half-wave rectificiation is obtained. If a double-diode and a suitable circuit is used, full-wave rectification can be obtained. ↑ AMPLIFIER[1] → RECTIFIER

NL036 thyratron (*n.*) A triode filled with a gas (*e.g.* mercury vapour, argon, helium, or neon) at a low pressure. The current from cathode to anode is very small unless a negative grid bias of a certain value, or a positive anode potential of a certain value, is applied. The gas then becomes ionized and a heavy current flows; once this current flows, the grid bias no longer controls the current flow. To stop the current flow, the positive anode potential must fall below a certain value. A thyratron has a similar function to a **thyristor** □ *the thyratron is fired by a certain grid bias* ↑ AMPLIFIER[1] → THYRISTOR · RECTIFICATION

NL037 space-charge limited (*adj.*) Describes the current flowing through a thermionic valve when a space-charge exists, and the current can be increased by increasing the anode potential. ↑ ELECTRONICS

NL038 reactance (*n.*) Coils and capacitors oppose the passage of alternating current by offering resistance; this is in addition to the type of resistance offered by a resistor (known as ohmic resistance). Reactance is either **inductive** (coils) or **capacitative** (capacitors). The symbol for reactance is X; it is measured in ohms, and is a property of alternating-current circuits only. In reactance, the current and p.d. are in quadrature, so there is no net dissipation of energy as heat; reactance must not be confused with resistance, although both are measured in ohms. ↓ IMPEDANCE · FILTER[2] · RESONANT CIRCUITS · POLARITY INVERTER · COUPLED ↑ ELECTRONICS

NL039 impedance (*n.*) The quantity which determines the current flowing in an inductive or capacitative component of a circuit when an alternating p.d. is applied. The magnitude of the impedance varies with the frequency of the a.c. The symbol for impedance is Z. Ohm's law for a.c. circuits is:

$$I = \frac{V}{Z}$$

Impedance depends on resistance (R) and reactance (X). For a single component:

$$Z = \sqrt{(R^2 + X^2)},$$

where X is either X_L or X_C. For an inductor:

$$Z = \sqrt{(R^2 + (\omega L)^2}.$$

For a capacitor and resistor in series:

$$Z = \sqrt{R^2 + \left(\frac{1}{\omega C}\right)^2}$$

For a resistor, inductor, and capacitor, connected in series:

$$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

↓ INDUCTIVE REACTANCE · CAPACITATIVE REACTANCE · LAG[2] · LEAD[2] · IMPEDANCE FACTOR · REACTOR ↑ REACTANCE

NL040 inductive reactance (*n.*) The self-inductance of a coil offers resistance to an alternating current; this is inductive reactance, and it is additional to the ohmic resistance of the coil. The symbol for inductive reactance is X_L; the magnitude of the reactance depends upon the self-inductance of the component (L) and the frequency of the alternating current (f):

$$X_L = 2\pi fL$$

Air-cored coils have a high reactance to high-frequency currents; they are called high-frequency chokes. Iron-cored coils smooth low-frequency currents; they are called low-frequency chokes. If ω (the Greek letter omega) is the angular frequency ($\omega = 2\pi f$), resistance can be expressed as:

$$X_L = \omega L.$$

In an inductor, the current lags 90° on the voltage. ↑ IMPEDANCE

NL041 capacitative reactance (*n.*) A capacitor offers resistance to the passage of alternating current; this is capacitative reactance. The symbol for capacitative reactance is X_C, and the magnitude of the reactance depends upon the capacitance (C) of the capacitor and the frequency (f) of the alternating current:

$$X_C = \frac{1}{2\pi fC} = \frac{1}{\omega C} \quad (\omega = 2\pi f)$$

At zero frequency (direct current) the capacitative reactance is infinite, *i.e.* no current passes. At high frequencies, the capacitative reactance is low. In a capacitor, the current leads 90° on the p.d. ↑ IMPEDANCE

NL042 lag[2] (*v.i.*) **1** (Ph.) When the current and p.d. of an alternating current are out of phase, the vector (i.e. current or p.d.) which reaches a peak after the other vector has reached a peak is said to lag, *e.g.* if the current reaches a peak after the p.d., then the current lags on the p.d. □ *current lags 90° on p.d.* **2** (G.S.) To take place at a later time than expected. —LAG (*n.*) ↓ LEAD[2] (I) ↑ IMPEDANCE

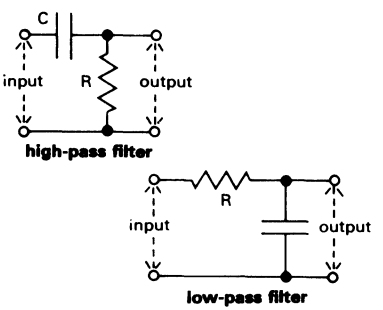
NL043 lead[2] (*v.i.*) When one vector (*e.g.* current or p.d.) of an alternating current reaches a peak before the other vector, it is said to lead, *e.g.* if the current reaches a peak before the p.d., then the current leads on the p.d. □ *current leads 90° on the p.d.* ↑ IMPEDANCE · LAG[2] (Cn)

NL044 impedance factor (*n.*) The ratio of the impedance of a device, or of a circuit, to its resistance:

$$\text{impedance factor} = \frac{Z}{R}$$

↑ IMPEDANCE

NL045 reactor (*n.*) A component of an electronic circuit which introduces reactance into the circuit. A capacitor or an inductor is a reactor; a reactor always possesses impedance. ↑ IMPEDANCE



FILTER CIRCUITS

NL046 filter[2] (*n.*) A device using a resistor and capacitor in series to remove certain frequencies of an alternating current. The impedance of the series combination is:

$$Z = \sqrt{R^2 + \frac{1}{\omega^2 C^2}}$$

At zero frequency ($\omega = 0$) the impedance is infinite. At very high frequencies, the impedance is almost equal to R. If the output is taken across the resistor (see diagram) a high-pass filter is obtained; high frequencies pass unaltered, but low frequencies are considerably reduced (d.c. is blocked completely). If the output is taken across the capacitor, high frequencies are considerably reduced, and low frequencies, including direct current, are passed. ↓ CRITICAL FREQUENCY · CUT-OFF FREQUENCY[1] · TIME CONSTANT · SMOOTHING CIRCUIT · BLOCKING CAPACITOR · BY-PASS CAPACITOR ↑ REACTANCE

NL047 critical frequency (*n.*) The frequency of an alternating current which is critical in separating high frequencies from low frequencies. The critical frequency depends upon the time constant for a resistor-capacitor circuit. If the capacitance is C, the resistance is R in the circuit, the critical frequency, f, is given by:

$$f = \frac{1}{2\pi CR}$$

↑ FILTER[2]

NL048 cut-off frequency[1] (*n.*) Alternative term for CRITICAL FREQUENCY, particularly used when a resistor is replaced by an inductor in a filter circuit. ↑ FILTER[2]

NL049 time constant (*n.*) When the voltage drop across the capacitor is identical with the voltage drop across the resistor, the filter is changing from high-pass to low-pass. At this point:

$$\omega = \frac{1}{CR}, \text{ i.e. } 2\pi f = \frac{1}{CR}$$

The product CR is the time constant for the combination. ↑ FILTER[2]

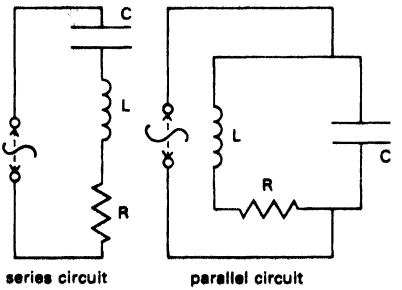
NL050 smoothing circuit (*n.*) A low-pass filter circuit with an inductor, called a smoothing choke, replacing the resistor. The cut-off frequency, (f), of the filter is given by:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

where L is the inductance of the choke and C the capacitance of the capacitor. ↑ FILTER[2] → SMOOTHING

NL051 blocking capacitor (*n.*) A capacitor in a circuit which filters out direct current from a circuit, but allows alternating current to pass. ↑ FILTER[2]

NL052 by-pass capacitor (*n.*) A capacitor of large capacitance (consequently of low impedance) connected in parallel with a resistor, or other component, acts as a by-pass to alternating currents; the a.c. passes through the capacitor in preference to the resistor. ↑ FILTER[2]



RESONANT CIRCUITS

NL053 resonant circuits (*n.pl.*) These consist of an inductor, a capacitor, and a resistor, connected in series or in parallel (see diagram). The inductor is considered to be a pure inductance (*i.e.* no resistance) and the resistor a pure resistance (*i.e.* no inductance).
For a series circuit:

$$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

This impedance is a minimum when

$$\omega L = \frac{1}{\omega C}, \quad i.e.\ \omega = \frac{1}{\sqrt{LC}}$$

At this frequency, the current has a large value. If a mixture of frequencies is supplied, only frequencies near the value of

$$f = 1/(2\pi\sqrt{LC})$$

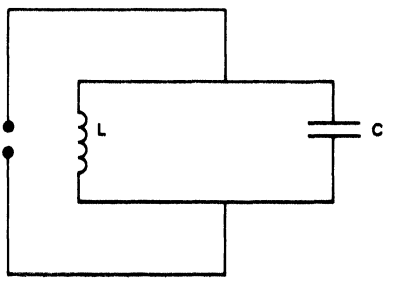
cause the current to become large, and the circuit resonates. The energy stored in the system passes backwards and forwards between the electric and magnetic fields associated with the circuit. At the resonant frequency the p.d. across the reactances builds up to a large value, with a well-designed coil, to as much as 200 times the original p.d., depending on the *Q*-factor of the coil. For the parallel circuit, the resonant frequency is given by:

$$\omega^2\left(1 + \frac{1}{Q^2}\right) = \frac{1}{LC}$$

where Q is the *Q*-factor. As Q is usually large, this reduces to the same frequency as for a series circuit. ↓ FEED-BACK · APERIODIC CIRCUIT · OSCILLATORY CIRCUIT · OSCILLATOR · Q-FACTOR · LCR CIRCUIT ↑ REACTANCE

NL054 feed-back (*n.*) A process of feeding energy from the output of a system back to the input. If the system amplifies intensity, a very rapid build-up of intensity occurs. If the energy is of an oscillatory nature, and the feed-back is in phase, it is called positive feed-back, and increases the amplitude of the oscillations. If the feed-back is out of phase, it decreases the amplitude and is negative feed-back. —***feed-back*** (*v.*) ↑ RESONANT CIRCUITS

NL055 aperiodic circuit (*n.*) A circuit in which no oscillations take place; this occurs if the resistance in a resonant circuit is large. A resistor with a high value changes a resonant circuit into an aperiodic circuit; an analogy is a pendulum swinging in a bath of oil. ↑ RESONANT CIRCUITS

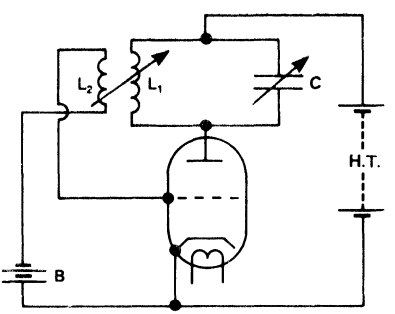


OSCILLATORY CIRCUIT

NL056 oscillatory circuit (*n.*) A circuit in which current oscillations can occur. The simplest oscillatory circuit consists of a coil and a capacitor (see diagram). The coil has an inductance, L, and the capacitor a capacitance, C. If oscillations are started, the frequency of the circuit is given by:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

The ohmic resistance of the coil dissipates energy as heat, so the oscillations will die away unless reinforced. ↑ RESONANT CIRCUITS



REACTION OSCILLATOR

NL057 oscillator (*n.*) A device consisting of an oscillatory circuit with a thermionic valve, or a transistor, coupled by a circuit, and power supplied by batteries. It produces an oscillatory current of fixed frequency depending on the capacitance and inductance of the oscillatory circuit. A reaction oscillator is shown in the diagram The

circuit with L_1 and C is the oscillatory circuit; the oscillatory current in L_1 induces an e.m.f. in the flux-linked coil L_2; providing L_2 is connected the right way round, it gives positive feed-back to the grid. Grid bias is supplied by the battery B, and the oscillatory e.m.f. from L_2 is amplified by the triode, and the e.m.f. is built up until the energy losses in the circuit are equal to the energy supply from the valve. The capacitor, C, is variable, hence the frequency can be altered. ↑ RESONANT CIRCUITS

NL058 Q-factor (*n.*) The quality of a coil in its function as an inductor; the symbol is Q. For an inductor,

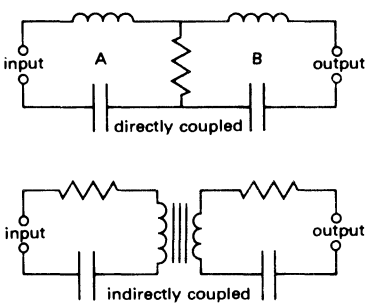
$$Q = \frac{\omega L}{R}$$

where L is the inductance, R the resistance of the coil, and ω is $2\pi \times$ frequency (of a.c.). For a perfect inductor, R is zero and Q is infinite. ↑ RESONANT CIRCUITS

NL059 LCR circuit (*n.*) A circuit containing inductors, capacitors, and resistances. It is a resonant circuit for certain values of L, C, and R. ↑ RESONANT CIRCUITS (Sn)

NL060 polarity inverter (*n.*) A device in an electronic circuit which produces an output of opposite polarity to the input, *i.e.* the positive peak of an alternating current is transformed to a negative peak in the output. A transformer produces polarity inversion, and can do so without amplification if the turns ratio is unity. ↓ PHASE INVERTER ↑ REACTANCE

NL061 phase inverter (*n.*) Although in common use, the correct term should be POLARITY INVERTER (↑) (Sn).



COUPLED CIRCUITS

NL062 coupled (*adj.*) Describes electrical circuits which affect each other. In directly coupled circuits, one component is a part of both circuits, so that the circuits are connected by contact. In the diagram a resistor couples the two circuits A and B. In an indirectly coupled circuit, there is no contact connection, but the two circuits are coupled by the flux linkage between two coils; the linkage can be through mutual induction with two coils, or through a transformer as shown in the diagram. ↑ REACTANCE

NL063 photo-electric effect (*n.*) Any effect by which energy is transferred from electromagnetic radiation (usually light, ultraviolet light, or X-rays) to electrons. The term is normally applied to the emission of electrons from solids when irradiated with electromagnetic radiations of sufficiently high frequency. ↓ PHOTOVOLTAIC EFFECT · PHOTOCELL · WORK FUNCTION · PHOTOMULTIPLIER · PHOTOSENSITIVE ↑ ELECTRONICS

NL064 photovoltaic effect (*n.*) A type of photo-electric effect in which two substances are united by a specially prepared boundary on which electromagnetic radiation falls; a potential difference is produced between the two substances. The photovoltaic effect is observed for junctions between copper and copper (I) oxide. ↓ PHOTOCONDUCIVE EFFECT · PHOTO-EMISSION · PHOTO-ELECTRON · PHOTOCONDUCTOR ↑ PHOTO-ELECTRIC EFFECT

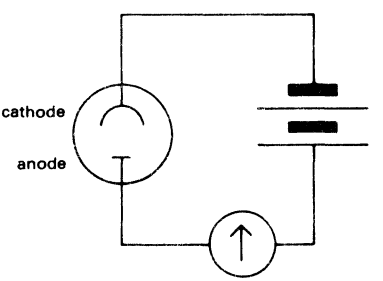
NL065 photoconductive effect (*n.*) A type of photo-electric effect in which the conductivity of a substance increases with increasing intensity of electromagnetic radiation irradiating the substance. ↑ PHOTOVOLTAIC EFFECT

NL066 photo-emission (*n.*) The process of emitting photo-electrons. —PHOTO-EMISSIVE (*adj.*) PHOTO-EMITTER (*n.*) ↑ PHOTOVOLTAIC EFFECT

NL067 photo-electron (*n.*) An electron emitted from the surface of a metal because of irradiation by electromagnetic radiation. ↑ PHOTOVOLTAIC EFFECT

NL068 photoconductor (*n.*) A substance, such as selenium, whose conductivity of electric charge increases when the intensity of electromagnetic radiation falling on it is increased. —***photoconductive*** (*adj.*) ↑ PHOTOVOLTAIC EFFECT

NL069 photocell (*n.*) Alternative term for PHOTO-ELECTRIC CELL (↓). ↓ RECTIFIER CELL · BARRIER LAYER CELL · PHOTOCHEMICAL CELL · PHOTO-EMITTER ↑ PHOTO-ELECTRIC EFFECT



PHOTOELECTRIC CELL IN CIRCUIT

NL070 photo-electric cell (*n.*) An electric cell which depends on the photo-emissive effect or the photovoltaic effect. The term usually describes a photo-emitter. This consists of a cathode coated with a photosensitive material and a metal anode, with the

electrodes contained in an evacuated glass tube, or one with a gas at a low pressure (this gives greater sensitivity). A potential is applied to the cell (see diagram); when light falls on the cathode, electrons are emitted, attracted to the anode, complete the circuit, and a current flows. The current is proportional to the intensity of the incident radiation, providing the p.d. across the cell exceeds a certain figure, depending on the characteristics of the cell. ↑ PHOTOCELL

NL071 rectifier cell (*n.*) A type of photoelectric cell depending upon the photovoltaic effect. It consists of specially prepared boundaries between two certain substances. A selenium photocell consists of an iron base plate on which there is fused a layer of selenium; light is incident on the selenium layer and the selenium and the iron form the two electrodes (or faces) of the cell. When the faces of the cell are connected a current flows and it can be detected by a galvanometer. This type of cell is mostly used for exposure meters as no external source of e.m.f. is needed. ↑ PHOTOCELL

NL072 barrier layer cell (*n.*) Alternative term for RECTIFIER CELL. ↑ PHOTOCELL

NL073 photochemical cell (*n.*) An electrolytic cell containing two electrodes of the same metal in a solution of an electrolyte; one electrode is irradiated with electromagnetic radiation, and a potential difference is formed between the two electrodes. An example is two plates of silver in a solution of an electrolyte, with one plate illuminated with light. ↑ PHOTOCELL

NL074 photo-emitter (*n.*) A surface or object that emits electrons when irradiated with electromagnetic radiation. The cathode in a photo-electric cell is a photoemitter. —PHOTO-EMISSION (*n.*) PHOTOEMISSIVE (*adj.*) ↑ PHOTOCELL

NL075 work function (*n.*) The minimum quantity of energy required to extract an electron from a given metal surface; the symbol is Φ (the Greek letter phi) and the quantity is measured in joules or electronvolts. The work function represents the minimum quantity of energy to cause electron emission. For electromagnetic waves:

$$\Phi = h\nu_0$$

where h is the Planck constant and ν_0 (the Greek letter nu) is the cut-off frequency. ↓ CUT-OFF FREQUENCY[2] · THRESHOLD FREQUENCY · THRESHOLD LEVEL · EINSTEIN'S PHOTO-ELECTRIC LAW ↑ PHOTO-ELECTRIC EFFECT

NL076 cut-off frequency[2] (*n.*) The minimum frequency of an electromagnetic radiation, under which photo-emission does not take place. It is given the symbol ν_0. The quantum of energy $h\nu_0$ is the minimum quantum required to eject an electron from the surface of a metal. For sodium, potassium, and similar metals, the cut-off frequency is in the visible region of the spectrum; for most other metals it is in the ultraviolet region. ↑ WORK FUNCTION

NL077 threshold frequency (*n.*) Alternative term for CUT-OFF FREQUENCY[2]. ↑ WORK FUNCTION

NL078 threshold level (*n.*) Alternative term for CUT-OFF FREQUENCY (↑); the term is better used for the energy level at which photo-emission starts, *i.e.* $h\nu_0$. ↑ WORK FUNCTION

NL079 Einstein's photo-electric law (*n.*) The law that the quantum of energy supplied by an electromagnetic radiation must be at least equal to the work function of a metal. When a larger quantum is supplied, the surplus energy is carried away as kinetic energy of the electron. If v is the maximum velocity of a photo-electron, m is its mass, ν is the frequency of the radiation, ν_0 is the cut-off frequency, and Φ is the work function, then:

$$\tfrac{1}{2}mv^2 = h\nu - \Phi = h(\nu - \nu_0)$$

This is the equation of Einstein's photoelectric law. ↑ WORK FUNCTION

NL080 photomultiplier (*n.*) A device using the principle of electron multiplication to detect very weak sources of light, or of other electromagnetic radiation of frequencies greater than those of light. It consists of a number of dynodes placed between the anode and the cathode. Electrons from the cathode strike the first dynode and each electron produces other electrons by secondary emission. These electrons are accelerated by a potential gradient (usually 1200 volts for 11 dynodes), and strike the next dynode. If each electron hitting a dynode produces 4 electrons, then the first electron produces 4^{11} or approximately 5×10^6 electrons reaching the anode. A large current can be obtained at the anode if the intensity of radiation is not weak. ↓ DYNODE · EXPOSURE METER ↑ PHOTO-ELECTRIC EFFECT

NL081 dynode (*n.*) An intermediate electrode in a photomultiplier, between the cathode and anode. The surface is specially treated so that, on secondary emission, up to four electrons are emitted for each electron striking the surface. ↑ PHOTOMULTIPLIER

NL082 exposure meter (*n.*) A photoelectric cell measuring the intensity of incident light, used in photography to determine the suitable length of time for exposure. ↑ PHOTOMULTIPLIER

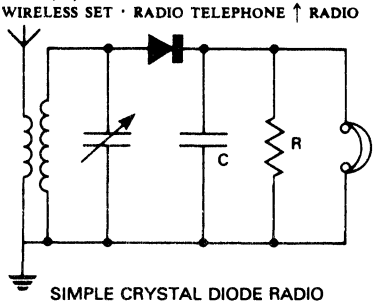
NL083 photosensitive (*adj.*) Describes any substance which exhibits a photoconductive, photo-electric, or photovoltaic effect, when irradiated with electromagnetic radiation of suitable frequency. ↓ PHOTO-EMISSIVE ↑ PHOTO-ELECTRIC EFFECT

NL084 photo-emissive (*adj.*) Describes any substance which emits electrons when irradiated with electromagnetic radiation of sufficiently high frequency. —PHOTO-EMISSION (*n.*) ↑ PHOTOSENSITIVE

Radio

NM001 radio (*n.*) The use of certain frequencies of electromagnetic radiation to communicate electrical signals; as no wires are employed in the communication, it is also known as ***wireless transmission***. Radio includes radio telephony, radio telegraphy, and broadcasting. A **radio transmitter** sends out the signal and a **radio receiver** accepts the signal. ↓ RADIO TRANSMITTER · MODULATION · RECEPTION · AERIAL[3] · GAIN · BROADCAST · AERIAL CIRCUIT · HETERODYNE EFFECT · SEMICONDUCTOR · TRANSISTOR · COMPUTER ↑ ELECTRONICS → RADIO WAVES

NM002 radio transmitter (*n.*) In broadcasting and radio telephony, the transmitter generates a carrier wave which is modulated by a microphone circuit. The modulated carrier wave is fed to an aerial and emitted. The term *transmitter* is a misnomer, as it should be a radio **emitter**, the carrier wave being transmitted by space. In radio telegraphy, the carrier wave is interrupted to form a series of long and short impulses based on the Morse code. —***radio transmission*** (*n.*) ↓ RADIO RECEIVER · RADIO SET · WIRELESS SET · RADIO TELEPHONE ↑ RADIO



SIMPLE CRYSTAL DIODE RADIO RECEIVER

NM003 radio receiver (*n.*) A device for receiving radio transmissions. The receiver has an aerial circuit adjusted to resonate to the carrier wave. The carrier wave is demodulated by rectification using a crystal rectifier, a thermionic valve, or a transistor. The audiofrequencies are either amplified by an amplifying circuit or fed directly to an earphone or loudspeaker with a bypass condenser to remove any radio frequencies. In the diagram an aerial circuit resonates to the carrier wave; this wave is rectified by the crystal diode. The capacitor, *C*, and resistor, *R*, have values such that the time constant for the combination is about 5×10^{-5} second. This period is long compared with the period of oscillation of radio frequencies, but short compared with that of audiofrequencies. The plates of the capacitor have a variation in p.d. which follows that of the audiofrequency. The audiofrequencies reproduce sound in the high-resistance earphones. ↑ RADIO TRANSMITTER

NM004 radio set (*n.*) Alternative term for RADIO RECEIVER.

NM005 wireless set (*n.*) Alternative term for RADIO RECEIVER (↑).

NM006 radio telephone (*n.*) A telephone system which uses radiofrequency electromagnetic waves instead of wires to communicate between microphone and receiver. ↑ RADIO TRANSMITTER → TELEPHONE

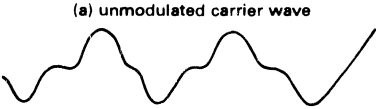
NM007 modulation (*n.*) The process of varying the characteristics of a wave motion by superimposing on it the characteristics of a second wave motion. The term is usually applied to a carrier wave, which has superimposed on it the characteristics of an audiofrequency wave. A carrier wave does not transmit a radio signal by itself, the signal (speech or vision) is carried by the modulated wave. There are three main types of modulation: amplitude modulation, frequency modulation, and phase modulation. —***modulated*** (*adj.*) ***modulate*** (*v.*) ↓ CARRIER WAVE · AUDIOFREQUENCY · RADIO FREQUENCY[2] · AMPLITUDE MODULATION · FREQUENCY MODULATION · PHASE · MODULATION · AM · FM · DEMODULATION (An) ↑ RADIO

NM008 carrier wave (*n.*) An electromagnetic wave of a radio frequency; it is a continuous wave of constant frequency and constant amplitude emitted by a radio transmitter. Sound and vision are transmitted by the carrier wave through modulation. ↑ MODULATION → RADIOFREQUENCY

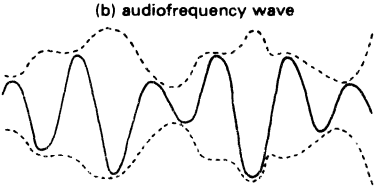
NM009 audiofrequency (*n.*) A frequency within the limits of audibility, *i.e.* between 50 Hz and 16 kHz approximately. —***audiofrequency*** (*adj.*) ↑ MODULATION

NM010 radio frequency[2] (*n.*) A frequency of electromagnetic waves between 3 kHz and 300 GHz. The term is also used to describe alternating currents with frequencies between these limits. ↑ MODULATION

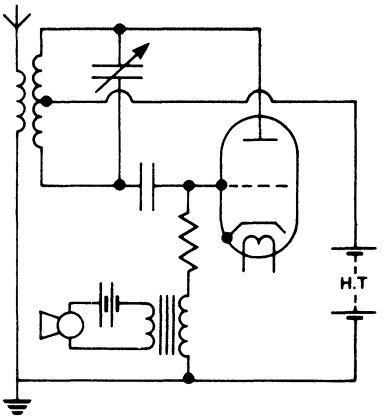
(a) unmodulated carrier wave



(b) audiofrequency wave



(c) modulated carrier wave



amplitude modulated transmitter

AMPLITUDE MODULATION

NM011 amplitude modulation (*n.*) Modulation in which the amplitude of the carrier wave is changed by the wave characteristics of the audiofrequency signal (see diagram). Modulation is carried out by the circuit shown. This consists of an oscillatory circuit powered by the high tension through the triode. The microphone circuit imposes a fluctuating p.d. on the control grid, and this alters the amplitude of the oscillations in the aerial circuit. This is the simplest method of modulation. ↑ MODULATION → AMPLITUDE[1]

NM012 frequency modulation (*n.*) Modulation in which the amplitude of the carrier wave remains constant and the wave characteristics of the audiofrequency wave are translated into changes of frequency of the carrier wave. The frequency of the carrier wave fluctuates above and below its nominal value; the number of fluctuations per second corresponds to the frequency of the audiofrequency wave, and the magnitude of the fluctuation corresponds to the amplitude of the audiofrequency wave. Frequency modulation can only be used with VHF radio carrier waves. ↑ MODULATION

NM013 phase modulation (*n.*) Modulation in which the amplitude and frequency of the carrier wave remain constant and the phase angle of the carrier wave is altered by an amount proportional to the instantaneous amplitude of the audiofrequency wave. ↑ MODULATION → PHASE[1]

NM014 AM (*abbr.*) Abbreviation for AMPLITUDE MODULATION (↑). ↑ MODULATION

NM015 FM (*abbr.*) Abbreviation for FREQUENCY MODULATION (↑). ↑ MODULATION

NM016 demodulation (*n.*) The separation and extraction of audiofrequency waves from a modulated carrier wave. The device or circuit used for demodulation is called a detector or demodulator. —DEMODULATOR (*n.*) ↑ MODULATION

NM017 reception (*n.*) The process of accepting, demodulating, and delivering sound from a loudspeaker, etc., in a radio receiver. **2** The quality of the signal received, including effects of distortion, atmospherics, fading, and other disturbances □ *good reception; poor reception* ↓ TUNING · DISTORTION[2] · FLUTTER[2] · WOW · ATMOSPHERICS · STATIC[2] · SELECTIVITY[1] · SELECTANCE ↑ RADIO → FADING

NM018 tuning (*n.*) The process of adjusting an oscillatory circuit until it resonates at a desired frequency. **2** The frequency to which a radio receiver is turned, and the degree of accuracy which it accepts that frequency and rejects frequencies next to it □ *fine tuning rejects frequencies close to the required frequency; coarse tuning accepts the required frequency and other frequencies close to it* ↑ RECEPTION

NM019 distortion[2] (*n.*) Alteration of speech or musical sounds by a radio receiver, caused by the amplification not being uniform over the range of audiofrequencies. The characteristics of thermionic valves are not straight lines over the whole range of amplification, and the audiofrequency wave is not regenerated as an exact replica of the original wave —DISTORT (*v.*) ↑ RECEPTION

NM020 flutter[2] (*n.*) Imperfect reproduction of sound by a radio receiver, or other machine, such as a tape recorder, caused by irregular distortion. ↑ RECEPTION

NM021 wow (*n.*) A slow flutter. ↑ RECEPTION

NM022 atmospherics (*n.pl.*) Noises interfering with radio reception, caused by electrical disturbances in the atmosphere, such as thunderstorms. ↑ RECEPTION

NM023 static[2] (*n.*) A general term for the electric effects producing atmospherics. ↑ RECEPTION

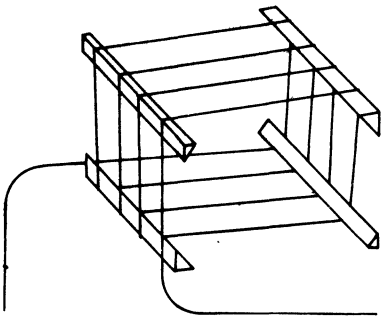
NM024 selectivity[1] (*n.*) The disposition of a radio receiver to accept carrier waves of a definite frequency and reject others with close frequencies. ↑ RECEPTION

NM025 selectance (*n.*) A measure of the selectivity of a radio receiver, *i.e.* it defines the limits of frequency outside which a carrier wave is rejected, but inside which carrier waves of those frequencies are accepted and may cause interference or heterodyning. ↑ RECEPTION

NM026 aerial[3] (*n.*) A wire or a structure of wires for emitting or receiving radio frequency electromagnetic waves. ↓ ANTENNA[2] · FRAME AERIAL · FRAME ANTENNA · DIPOLE AERIAL · DIPOLE[2] ↑ RADIO

NM027 antenna[2] (*n.,pl.* **antennae**) Alternative term for AERIAL[3] (Sn) (↑).

NM028 frame aerial (*n.*) A wire wound round a frame (see diagram). It forms a directional aerial; when the horizontal wires on the frame point in the direction of the transmitting station, reception is strongest; at right angles to this position, reception is weakest. When used to find direction, the position of minimum strength of reception is used. ↑ AERIAL[3]



FRAME AERIAL

NM029 frame antenna (*n.*) Alternative term for FRAME AERIAL. ↑ AERIAL[3]

NM030 dipole aerial (*n.*) An aerial consisting of two rods in a straight line with a gap in the middle. Leads from the two rods go straight to the demodulator circuit. The greatest flow of current occurs in the middle, especially when the aerial has a total length of one half of the wavelength of the incoming carrier wave. ↑ AERIAL[3]

NM031 dipole[2] (*n.*) Alternative term for DIPOLE AERIAL. ↑ AERIAL[3]

NM032 gain (*n.*) An alternative term for ***amplification***. ↓ AUTOMATIC GAIN CONTROL · AGC ↑ RADIO → AMPLIFIER[1]

NM033 automatic gain control (*n.*) The process in which the average strength of the received signal is made to control the amplification of the receiver. This counteracts fading. When the signal decreases, the amplification is increased. ↑ GAIN → FADING

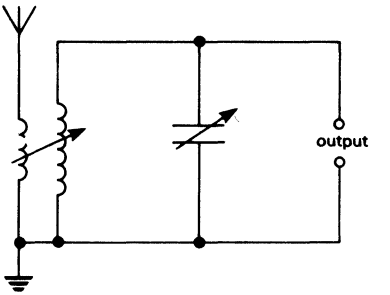
NM034 AGC (*abbr.*) Abbreviation for AUTOMATIC GAIN CONTROL. ↑ GAIN

NM035 broadcast (*v.t.,i.*) To send out radio or television signals that can be received by numerous receivers. —***broadcasting*** (*n.*) ↓ TUNE[1] · TUNE IN ↑ ADIO

NM036 tune[1] (*v.t.*) To alter the relative values of capacitance and inductance in an oscillatory circuit so that the circuit resonates at a desired frequency. —TUNING (*n.*) ***tuned*** (*adj.*) ↑ BROADCAST

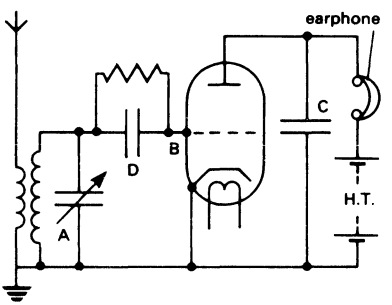
NM037 tune in (*v.t.*) To alter the tuning of the oscillatory circuit in a radio receiver until its frequency is identical with that of a desired transmitting station □ *to tune in on a broadcast; to tune in to a radio station* ↑ BROADCAST

NM038 aerial circuit (*n.*) A circuit in which a coil is connected to the aerial and to earth; the coil is flux-linked with a coil in an oscillatory circuit. The frequency of the oscillatory circuit can be altered, usually by a variable capacitor (see diagram). When correctly adjusted, the oscillatory circuit resonates to the required carrier wave; the alternating current from the oscillatory circuit is fed to the output. ↓ DEMODULATOR · DETECTOR · DISCRIMINATOR ↑ RADIO



AERIAL CIRCUIT

NM039 demodulator (*n.*) The part of the circuit in a radio receiver where the carrier wave is demodulated; *i.e.* the audiofrequency wave is separated from the radiofrequency wave and the latter is taken to earth. In the diagram, a triode is used for demodulation and amplification of an AM wave at the same time. The triode, B, rectifies the radio signal; the by-pass capacitor, C, filters out radiofrequencies and the audiofrequencies are passed through high-resistance earphones. For a FM wave, the demodulator stage consists of, ***a*** suppression of unwanted AM waves; ***b*** conversion of the FM wave into an AM wave; ***c*** demodulation of AM wave as above. —***demodulation*** (*n.*) ↑ AERIAL CIRCUIT → MODULATION



TRIODE DEMODULATOR

NM040 detector (*n.*) The part of a circuit in a radio receiver where the audiofrequency wave is separated from the radiofrequency wave. The detector is now more usually called the **demodulator**. ↑ AERIAL CIRCUIT

NM041 discriminator (*n.*) An electronic circuit used to convert frequency modulation or phase modulation into amplitude modulation. ↑ AERIAL CIRCUIT

NM042 heterodyne effect (*n.*) The effect in which the superposition of two waves of different but near frequencies produces a wave form with a frequency equal to the difference between the two frequencies of the superimposed waves. With sound waves,

the wave of lower frequency thus formed is called a beat. ↓ HETERODYNE WHISTLE · HETERODYNING · HETERODYNE RECEPTION · SUPERHETERODYNE ↑ RADIO → BEATS

NM043 heterodyne whistle (*n.*) If a radio receiver accepts two carrier waves whose frequencies are very close, the heterodyne effect produces a continuous wave with a frequency in the audible region; this is heard as a whistle. ↑ HETERODYNE EFFECT

NM044 heterodyning (*n.*) The process of producing a continuous heterodyne whistle. —***heterodyne*** (*v.*) ↑ HETERODYNE EFFECT

NM045 heterodyne reception (*n.*) A method of receiving radio signals. The radio receiver adds an oscillation of near frequency to that of the carrier wave; the result is a wave with a frequency in the audiofrequency region, capable of making sound. ↑ HETERODYNE EFFECT

NM046 superheterodyne (*n.*) Abbreviation for supersonic heterodyne. A form of heterodyne reception in which the low frequency wave produced by the heterodyne effect has a fixed supersonic frequency. The low frequency wave is first amplified and then demodulated. Using a superheterodyne receiver, the circuit is specially designed to amplify and demodulate the one frequency, and gives greater selectivity in reception. ↑ HETERODYNE EFFECT → SELECTIVITY

NM047 semiconductor (*n.*) A substance with conducting properties intermediate between those of a conductor (a metal) and an insulator. In contrast to conductors, the resistance of a semiconductor decreases with increasing temperature; other energizing forces, such as light, may also have the same effect on the semiconductor. Semiconductors may be elements or compounds, and include such substances as germanium, selenium, silicon, and lead telluride. ↓ INTRINSIC SEMICONDUCTOR · ENERGY BANDS · DONOR IMPURITY · SEMICONDUCTOR JUNCTION · FORWARD BIAS · DIODE[2] · THERMISTOR · OHMIC → ELECTRONICS

NM048 intrinsic semiconductor (*n.*) A type of semiconductor in which the electrical properties are characteristic of the pure substance. Intrinsic semiconductors contain an equal number of electrons and holes and their conductivity is low. ↓ EXTRINSIC SEMICONDUCTOR (An) · DOPING ↑ SEMICONDUCTOR

NM049 extrinsic semiconductor (*n.*) A type of semiconductor in which the electrical properties depend upon the presence of an impurity in the basic semiconductor material. The presence of 1 part in 10^7 of impurity can increase the conductivity of a semiconductor by a thousandfold. Examples of extrinsic semiconductors are germanium with arsenic as an impurity, and germanium with indium as an impurity. All semiconductors in practical use are extrinsic. ↑ INTRINSIC SEMICONDUCTOR (An)

NM050 doping (*n.*) The process of adding a very small quantity of an impurity to a semiconductor to obtain a particular electrical characteristic. —***dope*** (*v.*) ↑ INTRINSIC SEMICONDUCTOR

NM051 energy bands (*n.pl.*) Orbital electrons in isolated atoms can exist in a number of states of quantized energy; normally they occupy the ground state of least energy. In a crystalline solid, valency electrons enter into chemical bonds, and the number of quantized energy levels is greatly increased. The energy levels are very close together and form a continuous band of available quantized energies, called the valency band. An electron can gain energy from thermal vibrations of the crystal lattice, and be raised to a conduction band; it is then a free electron. Between the valency and conduction bands is the forbidden zone. The electrical properties of a crystalline solid depend upon the width of the forbidden zone. ↓ VALENCY BAND · CONDUCTION BAND · FORBIDDEN ZONE · FORBIDDEN BAND · ENERGY BAND DIAGRAM · FREE ELECTRON · HOLE ↑ SEMICONDUCTOR

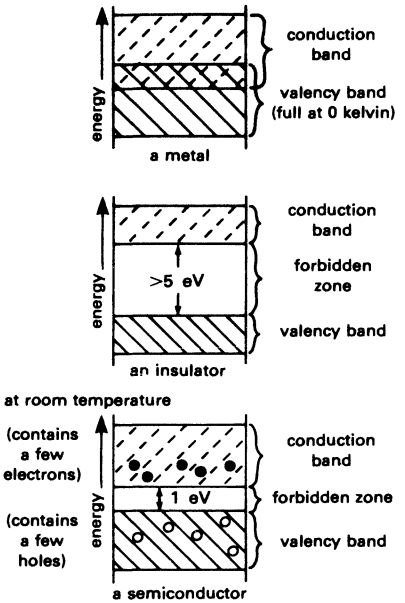
NM052 valency band (*n*) The band of quantized energy levels which can be occupied by an electron when in a valency orbital in a crystalline solid. An electron in this band is not usually free to move under the influence of an electric field. ↑ ENERGY BANDS

NM053 conduction band (*n.*) The band of quantized energy levels (higher than the energy levels of the valency band) into which an electron can be raised by thermal vibration of a crystalline lattice. The raising of one electron to this band leaves a hole in the valency band. The electrons in the conduction band are all free electrons and they can move under the influence of an electric field. ↑ ENERGY BANDS

NM054 forbidden zone (*n.*) The zone between the valency and conduction bands. It represents energy levels that cannot be occupied by electrons. If an electron is to be raised from a valency band to a conduction band, it must be given enough energy to pass through the forbidden zone. The width of the forbidden zone is most important in determining the conductivity of a crystalline solid. For metals, the width is zero; for good insulators the width is greater than 5 eV; for a semiconductor the width is about 1 eV. ↑ ENERGY BANDS

NM055 forbidden band (*n.*) A term sometimes used instead of FORBIDDEN ZONE. ↑ ENERGY BANDS

NM056 energy band diagram (*n.*) The diagrams indicate the energy bands for a metal, an insulator, and a semiconductor. The metal conducts electric current readily as electrons are always available in the conduction band; the conduction band and the valency band overlap for almost all metals. An insulator has too great a forbidden zone for electrons to cross at ordinary temperatures; at very high temperatures, the chances of raising an electron to the conduction band are increased, and



ENERGY BAND DIAGRAMS

insulation can break down *e.g.* glass at temperatures just below its melting point will conduct current. In an intrinsic semiconductor, a few electrons are available in the conduction band, so it conducts. Resistivities of semiconductors at room temperature are of the order of 1 ohm metre (compare the order of, *a* metals, 10^{-8} Ω m; *b* insulators, 10^{11} Ω m). Raising the temperature of a semiconductor raises more electrons to the conduction band, and the conductivity increases. ↑ ENERGY BANDS

NM057 free electron (*n.*) An electron in a crystal which is free to move under the influence of an electric field. If an electron is in a partially filled valency band it can be accelerated by an electric field, gain energy, and thus conduct electric current, *i.e.* it becomes a free electron. ↑ ENERGY BANDS

NM058 hole (*n.*) When an electron is raised from the valency band to the conduction band of energy levels, the absence of the electron creates a hole in the valency structure of a crystalline solid. Holes are of importance for the conduction of electric current in semiconductors. An electron from a nearby atom can fill the hole, and create a new hole; the movement of electrons in one direction from hole to hole is equivalent to the movement of holes in the opposite direction. A hole can be regarded as a mobile vacancy with a positive charge and with a mass and charge equivalent to that of an electron; mathematically it is therefore equivalent to a positron. The transfer of electric charge through the movement of holes gives rise to hole conduction. ↑ ENERGY BANDS

NM059 donor impurity (*n.*) An impurity added to a semiconductor substance with one valency electron more per atom than the semiconductor, *e.g.* germanium is a semiconductor with four valency electrons in an atom; to it is added a very small amount of arsenic, which has five valency electrons in an atom. The atoms of germanium and arsenic are of similar size, so the arsenic atom fits into the crystal lattice of the germanium. There is one valency electron of the arsenic with no place in the crystal lattice; this becomes a free electron in the conduction band. The atom of the impurity must be able to fit into the crystal lattice of the semiconductor, so it must be about the same size. ↓ ACCEPTOR IMPURITY · *n*-TYPE SEMICONDUCTOR · *p*-TYPE SEMICONDUCTOR · MAJORITY CARRIERS · MINORITY CARRIERS · HALL EFFECT · HALL COEFFICIENT ↑ SEMICONDUCTOR

NM060 acceptor impurity (*n.*) An impurity added to a semiconductor substance with one valency electron less per atom than the semiconductor, *e.g.* germanium with indium as an impurity; indium has three valency electrons in an atom, while germanium has four valency electrons. The atoms of indium fit into the germanium lattice but there is one electron too few, so a hole is created in the valency band energies. The addition of an acceptor impurity creates positive holes in the crystal lattice. ↑ DONOR IMPURITY

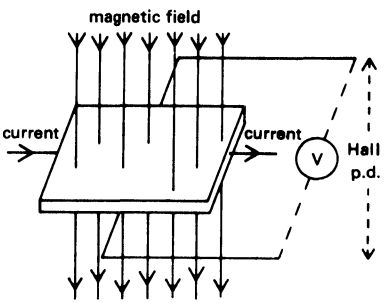
NM061 *n*-type semiconductor (*n.*) A type of semiconductor in which most of the current is carried by electrons (rather than holes). A donor impurity is added to a crystal of the semiconductor; the impurity level need be only 1 in 10^7. The donor provides a large number of electrons in the conduction band; it also reduces the number of holes. Electric current is now carried almost entirely by electrons, and the semiconductor is said to be an *n*-type (*n* for negative.) ↑ DONOR IMPURITY

NM062 *p*-type semiconductor (*n.*) A type of semiconductor in which most of the current is carried by holes (rather than electrons). An acceptor impurity is added to a crystal of the semiconductor; the impurity level need be only 1 in 10^7. The acceptor provides a large number of holes in the valency band; it also reduces the number of free electrons in the conduction band. Electric current is now carried almost entirely by holes, and the semiconductor is said to be a *p*-type (*p* for positive). ↑ DONOR IMPURITY

NM063 majority carriers (*n.pl.*) The type of current carrier (electrons or holes) that carries most of the electric current in a semiconductor. In *n*-type semiconductors, electrons are the majority carriers, in *p*-type, holes are the majority carriers. ↑ DONOR IMPURITY

NM064 minority carriers (*n.pl.*) The carriers that are not the majority carriers in a

semiconductor. In *n*-type and *p*-type semiconductors there are always a few minority carriers. Holes are the minority carriers in *n*-type semiconductors and electrons in *p*-type semiconductors. The proportion of minority carriers rises rapidly if the temperature rises because of the increased rate of production of electron-hole pairs. This limits the current-carrying capacity of those semiconductors which depend upon majority carriers for their proper functioning. ↑ DONOR IMPURITY



HALL EFFECT

NM065 Hall effect (*n.*) The development of a potential difference between the sides of a conductor (through which an electric current flows) when a magnetic field is applied to the conductor. The p.d. is in a direction perpendicular to the magnetic field. The p.d. produced is minute in metals, but appreciable (about 0·1 V) in semiconductors. ↑ DONOR IMPURITY

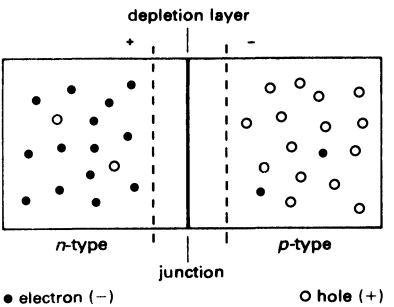
NM066 Hall coefficient (*n.*) The potential difference developed by the Hall effect is proportional to the flux density of the magnetic field, to the current density, and to the width of the conductor. The constant of this proportionality is called the Hall coefficient. The sign of the Hall coefficient (+ or −) depends on the electric charge of the majority carriers, *i.e.* for *p*-type semiconductors, holes or positive current carriers make the Hall constant positive. For *n*-type semiconductors, the coefficient is negative. Measurement of the Hall coefficient determines both the sign and the concentration of the majority carriers. ↑ DONOR IMPURITY

NM067 semiconductor junction (*n.*) A plane between two different types of semiconductor, *i.e.* an *n*-type and a *p*-type. An internal electric field is created at the junction by the drift of electrons and holes across the junction. ↓ DEPLETION LAYER · BARRIER LAYER · JUNCTION DIODE · SEMICONDUCTOR DIODE ↑ SEMICONDUCTOR

NM068 depletion layer (*n.*) At a semiconductor junction electrons diffuse from the *n*-type side and holes diffuse from the *p*-type side. The electrons and the holes combine and neutralize each other. A narrow depletion layer is formed on either side of the boundary, free of current carriers and therefore of high resistance. The *n*-type material is left positive with respect to the *p*-type material, creating an electric field. When this field is sufficiently high, further diffusion of electrons and holes ceases. ↑ SEMICONDUCTOR JUNCTION

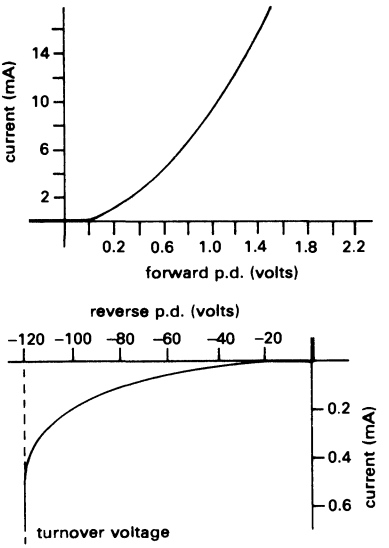
NM069 barrier layer rectifier (*n.*) An alternative term for rectifier cell or rectifier photocell. There are two types of cell, **back-layer** and **front-layer.** In a back-layer cell light passes through the semiconductor layer, *e.g.* selenium, and the cell is more sensitive to the red end of the spectrum. In a front-layer cell the semiconductor is coated with a transparent metal surface through which the light must pass and the cell is more sensitive to the blue end of the spectrum. ↑ SEMICONDUCTOR JUNCTION → RECTIFIER CELL

NM070 junction rectifier (*n.*) A junction diode used as a rectifier for an alternating current. ↑ SEMICONDUTOR JUNCTION · ↓ JUNCTION DIODE



JUNCTION DIODE

NM071 junction diode (*n.*) A type of semiconductor diode consisting of a junction between two types of material. The depletion layer at the boundary of a semiconductor junction is shown in the diagram. If a p.d. is applied to the crystal making the *p*-type material positive (and the *n*-type negative) the electric field of the depletion layer is reduced and a current flows across the junction carried by electrons from the *n*-type material and by holes from the *p*-type material. The current is due to majority carriers from both sides of the junction. If the p.d. is reversed, the electric field of the depletion layer is increased and flow of the majority carriers inhibited. A small current due to the minority carriers does flow, but the proportion of these carriers is very small. The junction conducts current when the *p*-type material is made positive (called the forward direction) but has a high resistance in the reverse direction. ↑ SEMICONDUCTOR JUNCTION



(note different axes for p.d. and current)

CHARACTERISTICS OF A SEMICONDUCTOR DIODE

NM072 semiconductor diode (*n.*) Alternative term for a CRYSTAL RECTIFIER. The characteristics of a semiconductor diode are shown in the diagram; the device is a junction diode. ↓ CRYSTAL RECTIFIER ↑ SEMICONDUCTOR JUNCTION

NM073 barrier layer (*n.*) Alternative term for DEPLETION LAYER (↑).

NM074 forward bias (*n.*) A potential difference applied to a semiconductor diode in the forward direction, *i.e.* in the direction causing majority carriers to convey the current. A very small increase in p.d. causes a large current to flow. The semiconductor junction has a low impedance with forward bias. ↓ REVERSE BIAS · TURNOVER VOLTAGE · ZENER EFFECT · AVALANCHE EFFECT · ZENER CURRENT ↑ SEMICONDUCTOR

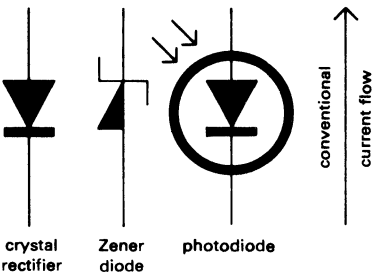
NM075 reverse bias (*n.*) A potential difference applied to a semiconductor diode in the reverse direction, *i.e.* in the direction causing minority carriers to convey the current. A very small current flows, almost independent of the voltage applied, until the turnover voltage is reached. The semiconductor junction has a high impedance, which decreases slightly with increasing p.d. until the turnover voltage is reached, then the impedence falls rapidly. ↑ FORWARD BIAS

NM076 turnover voltage (*n.*) The voltage at which a sufficiently high reverse p.d., applied to a semiconductor junction, breaks down the barrier layer. The electric field is sufficiently high to raise electrons straight to the conduction band, and correspondingly to create an equal number of holes in the valency band. ↑ FORWARD BIAS

NM077 Zener effect (*n.*) An effect occurring at the turnover voltage. The sudden creation of electron-hole pairs causes the current to rise abruptly. ↓ ZENER DIODE ↑ FORWARD BIAS

NM078 avalanche effect (*n.*) Alternative term for the ZENER EFFECT. ↑ FORWARD BIAS

NM079 Zener current (*n.*) In a semiconductor diode, the large current which flows when the turnover voltage is exceeded on reverse bias. ↑ FORWARD BIAS



SEMICONDUCTOR DIODE DEVICES

NM080 diode[2] (*n.*) Alternative term for a SEMICONDUCTOR DIODE (↑). The term is also used for a ***thermionic*** DIODE[1] (→); different circuit symbols are used for the two types. ↓ CRYSTAL RECTIFIER · POINT-CONTACT DIODE · CAT'S WHISKER · PHOTODIODE · POINT-CONTACT PHOTODIODE · ZENER DIODE · AVALANCHE DIODE ↑ SEMICONDUCTOR → THYRISTOR

NM081 crystal rectifier (*n.*) A rectifier made from a semiconductor, *e.g.* a germanium diode. The characteristics of a crystal rectifier are those of a junction diode. ↑ DIODE[2]

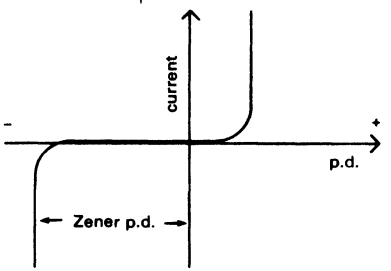
NM082 point-contact diode (*n.*) A type of diode in which a single *n*-type germanium crystal makes contact with a cat's whisker. A relatively high current is passed to form a thin layer of *p*-type semiconductor under the cat's whisker. This produces a junction diode which can be used at high frequencies of alternating current. The crystal diode, on the other hand, behaves like a leaky capacitor and is only usable at lower frequencies. ↑ DIODE[2]

NM083 cat's whisker (*n.*) A springy metal wire used to make contact with a semiconductor crystal in a point-contact diode. ↑ DIODE[2]

NM084 photodiode (*n.*) A germanium junction diode with *n*-type and *p*-type materials; reverse bias is applied to the diode and the junction can be illuminated by light passing through a window. With reverse bias, the small leakage current is caused by minority carriers; the energy of light photons creates extra electron-hole pairs, and the leakage current increases. The increase is proportional to the flux of light. ↑ DIODE[2] → PHOTOTRANSISTOR

NM085 point-contact photodiode (*n.*) A

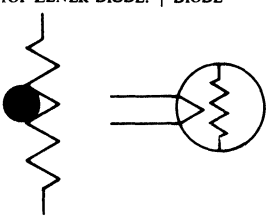
point contact diode with the germanium crystal illuminated with light passing through a window. The method of operation is the same as for a photodiode; the characteristics are the same as for a point-contact diode. ↑ DIODE[2]



CHARACTERISTICS OF A ZENER DIODE

NM086 Zener diode (*n.*) A type of silicon diode with a carefully adjusted level of impurity near the junction. This produces characteristics of the diode as shown in the diagram; the characteristic beyond the turnover voltage becomes almost a vertical line. Zener diodes can be made to operate with a Zener voltage at any p.d. between 4 V and 100 V. They are used in voltage stabilization circuits. ↑ DIODE[2]

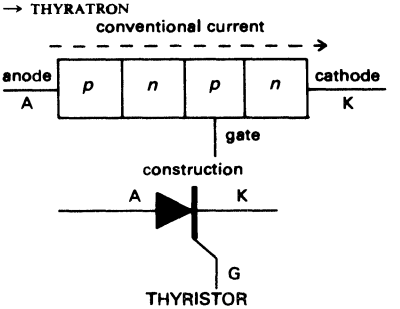
NM087 avalanche diode (*n.*) Alternative term for ZENER DIODE. ↑ DIODE[2]



SYMBOLS FOR A THERMISTOR

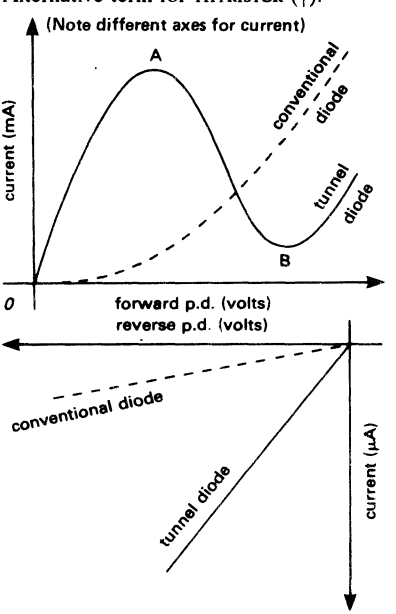
NM088 thermistor (*n.*) A semiconductor device whose resistance changes quickly with temperature. Thermistors are not made of the usual materials, such as germanium and silicon. They consist of sintered oxides of iron, nickel, manganese, titanium, cobalt, copper, etc., pressed into a pellet, and baked at high temperatures. The pellet is silver coated and leads are attached. The symbols for a thermistor are shown in the diagram. Its characteristic is a great increase in conductivity with rise in temperature, *e.g.* the resistance decreases from 10^5 ohms at 20°C to 10 ohms at 100°C. At higher temperatures, the resistance starts to rise again. Thermistors are used as sensitive measuring devices for temperatures, or to compensate for temperature variations in a circuit. ↓ THYRISTOR · TRIGGERING LEVEL · SILICON CONTROLLED RECTIFIER · TUNNEL DIODE · TUNNEL EFFECT ↑ SEMICONDUCTOR

NM089 thyristor (*n.*) A four layer, *p–n–p–n*, semiconductor device with three electrodes called the anode, cathode, and gate. Positive current can flow from anode to cathode, subject to control by the gate. It is similar to an ordinary rectifying semiconductor diode, but conduction only takes place when a sufficiently high current, with an applied positive potential with respect to the cathode, flows through the gate. Once the thyristor has been fired by this current, conduction continues even though the gate current is cut off. The conduction can be stopped by removing the anode potential or reducing it to a very low value. If alternating current is applied to the anode and cathode, rectification takes place only from the position when the thyristor fires; this can reduce the average output voltage □ *a thyristor is fired by a gate signal* ↑ THERMISTOR → THYRATRON



NM090 triggering level (*n.*) The gate voltage which fires a thyristor. ↑ THERMISTOR

NM091 silicon controlled rectifier (*n.*) Alternative term for THYRISTOR (↑).



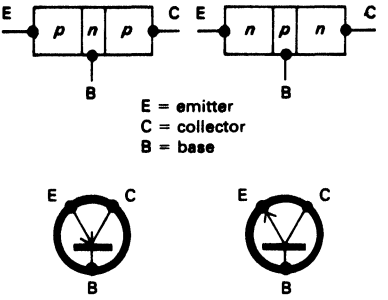
CHARACTERISTICS OF A TUNNEL DIODE

NM092 tunnel diode (*n.*) A semiconductor diode which can have a negative resistance, *i.e.* current decreases as voltage increases over part of its operating range. It consists of a *p–n* junction with large numbers of impurity atoms in the *p* and *n* regions, *i.e.* large numbers of holes and electrons are available. The characteristics of the tunnel diode are shown in the diagram. If a small forward p.d. is applied, a current of electrons flows as a result of the tunnel effect, in spite of the high potential of the barrier layer produced by the large number of holes and electrons. After reaching point A on the forward characteristic, the tunnel effect is reduced, and the current decreases with increasing potential, exhibiting negative resistance between points A and B on the characteristic. After point B, the normal majority carrier current flows. The tunnel diode can be used as an amplifier, an oscillator, or in switching circuits, using frequencies up to 2000 MHz. The tunnel diode has a low consumption of current, and its characteristics do not vary with temperature (as do the characteristics of all other semiconductor devices); the characteristics remain virtually constant. ↑ THERMISTOR

NM093 tunnel effect (*n.*) The effect in which a free electron can pass through a potential energy barrier although the electron has insufficient kinetic energy to surmount the barrier. It is observed, ***a*** in metals, where free electrons are extracted from the surface without apparently sufficient electrical energy; ***b*** in semiconductors where electrons penetrate the barrier layer potential although they have insufficient energy to surmount the barrier layer potential. The effect is explained by wave mechanics. An electron is represented by a wave equation; by the Uncertainty Principle, either its position in space or its momentum is known accurately, but not both. The wave representing an electron can be reflected or transmitted by a barrier; the transmitted component gives the probability of an electron penetrating the barrier, *i.e.* its probable position in space. The ease of penetration depends on the width of the barrier. The ease of penetration is increased by a high electric field. This is provided in a tunnel diode by a high barrier layer potential across a narrow barrier layer. ↑ THERMISTOR

NM094 ohmic (*adj.*) **1** Describes a resistance which has no inductive effect, *i.e.* the impedance and resistance are the same. **2** Describes a contact between a metal and a semiconductor, *i.e.* a junction which has no depletion layer. ↑ SEMICONDUCTOR

NM095 transistor (*n.*) A device consisting of two *p–n* semiconductor junctions joined together to form a *p–n–p* or an *n–p–n* structure. Most transistors are *p–n–p* type. Symbols for the two types are shown in the diagram. The middle layer is called the base of the transistor, and the two outside layers are the emitter and the collector. The main



SYMBOLS FOR TRANSISTORS

current flow is from the emitter to the collector; these are comparable (in an *n–p–n* transistor) to the cathode and anode of a thermionic valve. The current passes through the base, and the input signal is applied to the base, which can be compared to the grid of a thermionic valve, as it controls the passage of the main current. ↓ EMITTER · *p–n–p* TRANSISTOR · COLLECTOR CHARACTERISTICS · COMMON-BASE CIRCUIT · STABILIZATION[2] · BOTTOMED ↑ ELECTRONICS

NM096 emitter (*n.*) The region in a transistor from which the current carriers flow. In a *p–n–p* transistor, the emitter is a *p*-type semiconductor (usually germanium) rich in holes. In an *n–p–n* transistor it is an *n*-type semiconductor, rich in electrons. ↓ BASE[2] · COLLECTOR · EMITTER DIODE · COLLECTOR DIODE · BIAS[2] ↑ TRANSISTOR

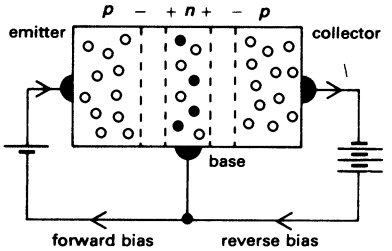
NM097 base[2] (*n.*) A piece of semiconductor sandwiched between two pieces of opposite type, *e.g.* a *n*-type semiconductor sandwiched between two *p*-type pieces of semiconductor. The base must be thin to allow electrons or holes to diffuse quickly through the layer. Its potential controls the current flow through the transistor. ↑ EMITTER

NM098 collector (*n.*) The region in a transistor into which the current carriers flow. It is a piece of semiconductor of the same type as the emitter. ↑ EMITTER

NM099 emitter diode (*n.*) The emitter and base of a transistor considered as a diode. Forward bias is applied and the impedance is low. ↑ EMITTER → FORWARD BIAS

NM100 collector diode (*n.*) The collector and base of a transistor considered as a diode. Reverse bias is applied and the impedance is high. ↑ EMITTER

NM101 bias[2] (*n.*) A transistor can be regarded as two junction diodes joined back to back. A forward bias is applied to one junction and a reverse bias to the other (see diagram for a *p–n–p* transistor). The forward bias is at a low voltage and current movement is almost entirely by holes from the emitter to the base. The holes diffuse across the base, which must be thin, otherwise electrons would neutralize the holes. The holes are then quickly swept to the collector. The emitter-base circuit with a forward bias has a low impedance; the base-

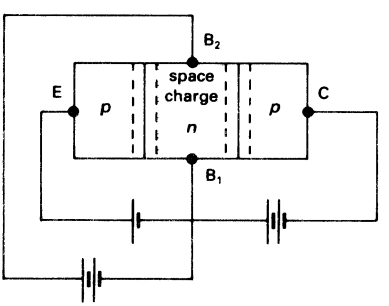


BIAS ON TRANSISTORS

collector circuit with a reverse bias has a high impedance. ↑ EMITTER

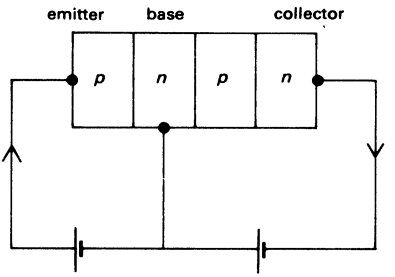
NM102 *p–n–p* transistor (*n.*) A transistor in which the emitter and collector are *p*-type and the base is *n*-type. A positive voltage is applied to the emitter and a negative voltage to the collector. A large number of holes in the emitter layer are attracted to the base, which, if sufficiently thin, will allow the holes to pass through and be attracted into the negative collector. The magnitude of the collector current depends on the forward bias applied to the base. In a typical small transistor a forward bias of 0·2 V on the emitter-base junction produces a current of 5 mA of which 4·9 mA passes to the collector and 0·1 mA passes to the base lead. The collector current is scarcely affected by the collector potential, provided it is greater than a particular value. ↓ *n–p–n* TRANSISTOR · TETRODE TRANSISTOR · *p–n–p–n* JUNCTION TRANSISTOR · PHOTOTRANSISTOR ↑ TRANSISTOR

NM103 *n–p–n* transistor (*n.*) A transistor in which the emitter and collector are *n*-type and the base is *p*-type. A negative voltage is applied to the emitter and a positive voltage to the collector. The transistor current is carried by electrons. The principle of operation of the *n–p–n* type is identical to that of the *p–n–p* type. ↑ *p–n–p* TRANSISTOR



TETRODE TRANSISTOR

NM104 tetrode transistor (*n.*) A conventional *p–n–p* or *n–p–n* junction transistor with two base connections, labelled B_1 and B_2 in the diagram. B_1 is connected to the base in the conventional way for a transistor. B_2 is given positive bias with respect to B_1 to cause holes to stray near to base B_1 connection (a *p–n–p* transistor is illustrated). For a *n–p–n* transistor, B_2 is given a negative bias. The majority carriers are thus repelled from B_2 by the space charge formed there. This effect lowers the base resistance and the frequency response is improved, *i.e.* an identical effect to making the base thinner. Lowering the base resistance gives lower gain for current, voltage, and power, but allows much higher frequencies to be used. ↑ *p–n–p* TRANSISTOR

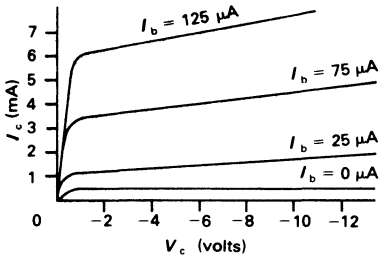


p–n–p–n JUNCTION TRANSISTOR

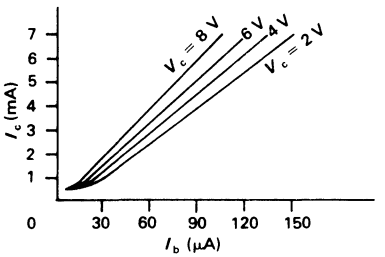
NM105 *p–n–p–n* junction transistor (*n.*) A transistor with four layers. The emitter diode is forward biased; the collector is reverse biased. A base current provides a sufficient number of holes to arrive at the last (*p–n*) junction; this lowers the barrier potential, and a large flow of electrons takes place between the base and the collector. Current gains of up to 20 can be obtained. The transistor gives a current gain with a common base circuit. ↑ *p–n–p* TRANSISTOR

NM106 phototransistor (*n.*) A *p–n–p* junction transistor with light falling on the base region. The light creates electron-hole pairs in the base, and if the base is sufficiently thin, the holes are swept into the collector, and a current flows out of the base region. The base current is amplified with the transistor connected to a common emitter circuit. The phototransistor thus acts as a photodiode with current amplification. The photosensitivity of a phototransistor is 300 mA per lumen compared with 8 mA per lumen for a photodiode and 0·5 mA per lumen for a selenium photoelectric cell. ↑ *p–n–p* TRANSISTOR → PHOTODIODE · PHOTOELECTRIC CELL

NM107 collector characteristics (*n.pl.*) Curves showing the relation between the collector applied p.d. (V_c) and the collector current (I_c) for a common emitter output (see diagram). Each characteristic is for a different base current (I_b). The characteristics for a common base output are similar in shape, with a series of characteristics for different emitter currents (I_e) but I_c only approaches the value of I_e as V_c increases. The characteristics for a common collector



(a) COLLECTOR CHARACTERISTICS



(b) TRANSFER CHARACTERISTICS

output are similar to those for a common emitter. ↓ TRANSFER CHARACTERISTICS · LEAKAGE CURRENT · AMPLIFICATION FACTOR[2] · CURRENT GAIN · POWER GAIN · LOAD LINE ↑ TRANSISTOR

NM108 transfer characteristics (*n.pl.*) Curves showing, for common emitter outputs, the relation between collector current (I_c) and base current (I_b) (see diagram). For each value of the collector p.d. (V_c) there is a different characteristic, almost a straight line. For different values of V_c, the gradient varies, but only over a range of approximately ±10%. For common base outputs, the relation is between I_c and the emitter current (I_e). The characteristics for common collector outputs are similar to those of common emitter outputs. ↑ COLLECTOR CHARACTERISTICS

NM109 leakage current (*n.*) The leakage current in a transistor results from holes and electrons being released by thermal ionization arising from thermal vibration of the crystal lattice. Even when the collector potential is zero, residual holes in the base (of a *p–n–p* transistor) flow to the collector. For this reason, the transfer characteristics do not pass through the origin (0 mA, 0 V). The leakage current (I_{co}) is always additional to the collector current (I_c).

$$I_c = \beta I_b + I_{co}$$

for a common emitter circuit. The leakage current increases rapidly with temperature (increased thermal ionization); it has the effect of displacing the transfer characteristic upward. ↑ COLLECTOR CHARACTERISTICS → PELTIER EFFECT

NM110 amplification factor[2] (*n.*) If I_e is the current entering the emitter, I_b is the current leaving the base, and I_c is the current leaving the collector, then:

$$I_e = I_b + I_c$$

A small leakage current (I_{co}) flows from base to collector and this increases the effective collector current. If the temperature of the transistor increases, the leakage current increases rapidly (from 50 μA at 20°C to 500 μA at 40°C). For common emitter circuits, the amplification factor, β (the Greek letter beta), is given by:

$$\beta = \frac{I_c}{I_b}$$

(See diagram for transfer characteristics.) The average value of the gradient for differing values of V_c is taken as the amplification factor. This represents a large current gain and a high power gain at the output. For common base circuits the amplification factor α is given by:

$$\alpha = \frac{I_c}{I_e}$$

The value of α, never exceeds unity, but a power gain arises from the different impedances for the forward and reverse bias circuits. The relation between the two factors is:

$$\beta = \frac{\alpha}{1 - \alpha}$$

↑ COLLECTOR CHARACTERISTICS

NM111 current gain (*n.*) Alternative term for AMPLIFICATION FACTOR. In a typical transistor I_e = 1 mA; I_b = 0·02 mA; I_c = 0·98 mA (with no allowance for leakage current). Current gain is:

a for common-base circuit:

$$\alpha = \frac{0{\cdot}98 \text{ mA}}{1{\cdot}00 \text{ mA}} = 0{\cdot}98$$

b for common-emitter circuit:

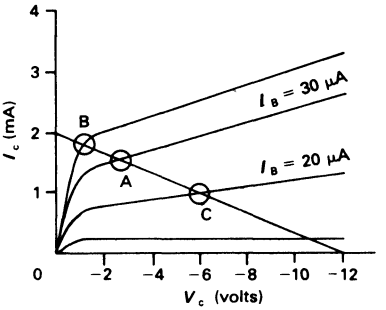
$$\beta = \frac{0{\cdot}98 \text{ mA}}{0{\cdot}02 \text{ mA}} = 49$$

c for common-collector circuit:

$$\beta = 49 \text{ also}$$

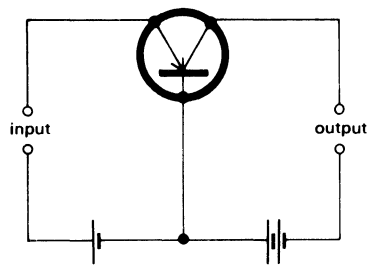
A transistor operates by amplifying currents, in contrast to a thermionic valve, which operates by amplifying voltages. ↑ COLLECTOR CHARATERISTICS

NM112 power gain (*n.*) The input impedance of a transistor depends on the current flowing in the input circuit, and the collector potential. The output impedance depends on the collector current and external circuit impedance. In a common base circuit, an input at the emitter of 1 mA at 0·1 V supplies 0·1 mW. The output on the collector is 0·9 mA (α = 0·9) at −5 V; this delivers 4·5 mW. The power gain is 45. ↑ COLLECTOR CHARACTERISTICS



LOAD LINE

NM113 load line (*n.*) The load line indicates how the output potential across an ohmic resistor varies with the input current. The load line for a common emitter circuit is shown in the diagram. The working point of the transistor is given by point A, *i.e.* $I_c = 1{\cdot}5$ mA; $V_c = 3{\cdot}0$ V; $I_b = 30$ μA. If the base current falls by 10 μA, the collector current falls to 1 mA, and the collector voltage rises to −6 V, as the voltage drop across the resistor has decreased. If the base current rises by 10 μA, the collector current rises to 1·8 mA, and the collector voltage falls to −1 V. (This would show non-linear amplification.) A load line shows the amplification factor under working conditions. ↑ COLLECTOR CHARACTERISTICS

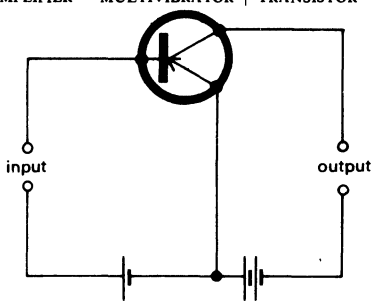


COMMON BASE CIRCUIT

NM114 common-base circuit (*n.*) An amplifying transistor circuit in which the base terminal is common to tne input and output (see diagram). The input provides a variation in the emitter current, producing a corresponding change in the collector current. The current gain is less than unity, the voltage gain greater than unity, and the power gain is high. For a typical low-power transistor, the impedance of the emitter diode is 25 ohms, and the impedance of the

gain is $\alpha^2 \times \frac{100\,000}{25}$, but the power gain is

shared between the collector diode and the load, so the useful output power depends on the impedance of the output. ↓ COMMON-EMITTER CIRCUIT · COMMON-COLLECTOR CIRCUIT · SIGNAL · GROUNDED BASE CIRCUIT · AMPLIFIER[2] · MULTIVIBRATOR ↑ TRANSISTOR



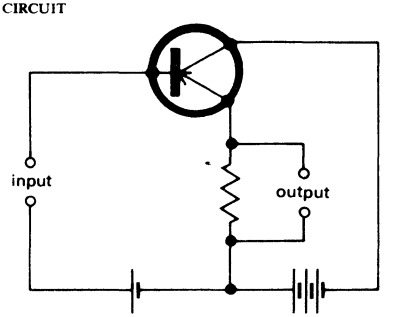
COMMON EMITTER CIRCUIT

NM115 common-emitter circuit (*n.*) An amplifying transistor circuit in which the emitter terminal is common to the input and output (see diagram). The input provides a variation in the base current, resulting in a change in the collector current. The current and voltage gains are greater than unity; the power gain is high. For a typical low-power transistor, the impedances are 600 Ω for the input and 25 kilo-ohms for the output. The

power gain is $\frac{25\,000}{600} = 41{\cdot}7$. A higher

leakage current is also apparent. Common-emitter circuits are used more often than either common-base or common-collector circuits. ↑ COMMON-BASE CIRCUIT

NM116 common-collector circuit (*n.*) An amplifying transistor circuit in which the collector terminal is common to the input and output (see diagram). The input produces a variation in the base current, resulting in a corresponding change in the current between emitter and collector. The current gain is the same as for a common emitter, the voltage gain is less than unity, and the power gain is high. The input and output impedances depend upon the amplification factor. ↑ COMMON-BASE CIRCUIT

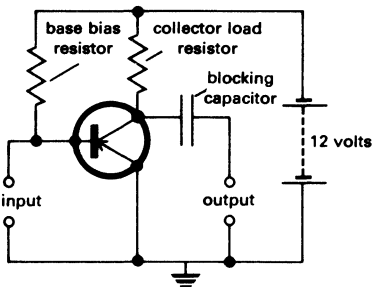


COMMON COLLECTOR CIRCUIT

NM117 signal (*n.*) Any current or p.d. obtained from an outside source or a previous stage in a circuit, which is fed into an

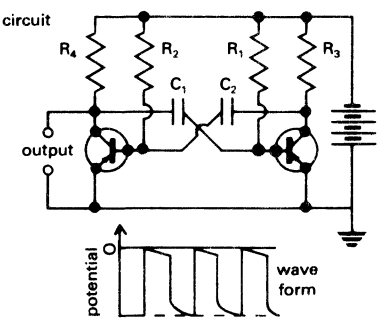
input of a transistor (or a thermionic valve). The transistor is operating at steady p.d.s applied to the emitter diode and the collector diode, producing steady emitter, base, and collector currents. The signal imposes a change of current at the input, and the transistor produces a corresponding change of current at the output. Both changes are measured from the steady current as a reference point. In a thermionic valve, the signal imposes a change of p.d., and produces a corresponding change of p.d. in the output. ↑ COMMON-BASE CIRCUIT

NM118 grounded base circuit (*n.*) Alternative term for COMMON-BASE CIRCUIT (↑).



AMPLIFIER

NM119 amplifier[2] (*n.*) A circuit for amplification, using a transistor, is shown in the diagram. The base bias resistor supplies a negative potential to the base; the collector load resistor supplies a negative potential to the collector. The emitter is earthed, but is at a positive potential with respect to the base and collector. The circuit is a common-emitter type. The blocking capacitor removes the direct current p.d., so only variations in current from the input are amplified and passed to the output. ↑ COMMON-BASE CIRCUIT



MULTIVIBRATOR

NM120 multivibrator (*n.*) A type of oscillator producing a waveform which is approximately rectangular, *i.e.* either full or zero amplitude, for p.d. against time. The circuit (see diagram) consists of a two-stage common-emitter amplifier with the output fed directly back into the input of each stage. The feedback is positive and the circuit highly unstable. R_3 and R_4 are collector load resistors; the current grows in one transistor until the transistor is bottomed. The change of potential occurs rapidly, but the capacitor cannot transmit such a rapid change and it holds the other transistor effectively non-conducting. The capacitor then discharges and the second transistor rapidly changes to the opposite state of conducting. The period of oscillation is approximately proportional to $(C_1R_1 + C_2R_2)$. If C_1 and C_2 have identical capacitance and R_1 and R_2 have identical resistance, and R_3 and R_4 have identical resistance, the device becomes a square-wave generator. ↑ COMMON-BASE CIRCUIT

NM121 stabilization[2] (*n.*) Rapid variation of leakage currents with temperature adversely affects the characteristics of a transistor. Stabilization is a method of preventing the transistor from becoming too hot when a current passes through it. This is achieved by making the collector-to-emitter potential difference less than half the supply voltages. A fully stabilized circuit has this factor incorporated □ *full stabilization is obtained by adjusting the collector voltage* —STABILIZE (*n.*) ***stabilized*** (*adj.*) ↓ THERMAL RUNAWAY · HEAT SINK ↑ TRANSISTOR

NM122 thermal runaway (*n.*) The effect when the rise in temperature in a transistor becomes too great, the leakage current becomes excessive, and the transistor is destroyed. ↑ STABILIZATION[2]

NM123 heat sink (*n.*) Transistors required to deliver large power amplifications may become too hot. To prevent this, the transistor is mounted on a block of metal (the heat sink) which conducts away the heat. A similar device is employed with some semiconductor diodes, and other electrical devices. Heat sinks are only necessary with large, high-power transistors. ↑ STABILIZATION[2]

NM124 bottomed (*adj.*) Describes the condition of a transistor when the collector potential is zero, or almost zero, and no collector current passes, *i.e.* the transistor is not functioning. ↑ TRANSISTOR

NM125 computer (*n.*) A machine that is a computing device able to accept data in a specified form, to process the data, and to supply the results in one of several specified forms. The processes include simple mathematical operations, logical processes, and control of other machines and devices. ↓ DATA · PROCESS[4] → ELECTRONICS

NM126 data (*n.pl.*) **1** The figures and facts, including words, accepted by a computer. **2** The figures recorded from the results of an experiment. ↑ COMPUTER

NM127 process[4] (*v.t.*) To carry out a process on data for a particular purpose. The processing can be carried out by a person, using mechanical devices, or by a computer. ↑ COMPUTER

Chemical Laws

NN001 law of constant composition (*n.*) The law that no matter how a chemical compound is prepared, it always contains the same elements in the same proportion by mass. ↓ STOICHIOMETRY · STOICHIOMETRIC

NN002 stoichiometry (*n.*) The study of the laws of chemical combination of elements by mass and volume. —STOICHIOMETRIC (*adj.*) ↓ STOICHIOMETRIC COMPOUND · INTERSTITIAL COMPOUND · SANDWICH COMPOUND · ZEOLITE

NN003 stoichiometric compound (*n.*) A compound which obeys the law of constant composition and can be represented by a simple whole number formula, *e.g.* sodium chloride is a stoichiometric compound.

NN004 non-stoichiometric compound (*n.*) A compound which does not obey the law of constant composition, *e.g.* iron sulphide is a non-stoichiometric compound; it cannot be represented by a simple whole number formula. Many transition metal oxides are non-stoichiometric, *e.g.* $Fe_{0.95}O$. ↑ STOICHIOMETRY

NN005 Berthollide compound (*n.*) An alternative name for NON-STOICHIOMETRIC COMPOUND, named after Berthollet (1742–1822) who did not accept that the Law of Constant Composition was always true. ↑ STOICHIOMETRY

NN006 interstitial compound (*n.*) A compound, usually of transition elements, in which the tetrahedral holes or octahedral holes (interstices) in the close packed, face-centred cubic lattice have non-metallic atoms, such as hydrogen, carbon and nitrogen. These elements have atoms small enough not to distort the metal lattice. ↑ STOICHIOMETRY

NN007 sandwich compound (*n.*) A compound in which metal atoms are held between layers of carbon or boron atoms in a graphite structure, *e.g.* KC_8 KC_{24} CaB_6. ↑ STOICHIOMETRY

NN008 zeolite (*n.*) A mineral with an alumino-silicate framework. The alumino-silicate framework is basically a framework of (SiO_4) tetrahedra forming cross-linked layers in which some of the silicon (Si) atoms are replaced by aluminium atoms (Al), *e.g.* natrolite $Na_2Al_2Si_3O_{10}$ is a zeolite. The sodium ions are replaceable by other cations. For this reason zeolite compounds are useful in water softening and in ion exchange processes. ↑ STOICHIOMETRY

NN009 stoichiometric (*adj.*) Describes compounds which obey the law of constant composition and the law of multiple proportions. —STOICHIOMETRY (*n.*) → LAW

Animal Vascular Systems

PA001 vascular system (*n.*) **1** (In higher plants) the tissues forming a continuous series of connecting vessels throughout all parts of the plant. Its function is the conduction of water, dissolved mineral salts and soluble synthesized food substances; it also provides mechanical support. **2** (In animals) a continuous series of connecting vessels. Its function is the conduction of fluids, such as blood and lymph, around the body. ↓ VASCULAR · HAEMOCOEL · BLOOD VESSEL · CIRCULATORY SYSTEM · HEART · HEART BEAT · BLOOD · TRANSPIRATION

PA002 vascular (*adj.*) Consisting of, containing or concerning vessels which conduct liquids. In plants the liquids are water, solutions of inorganic salts or solutions of synthesized foods. In animals the liquid is usually blood, or blood and lymph in vertebrates □ *the choroid of the eye is highly vascular—it contains many blood vessels in the tissue* ↑ VASCULAR SYSTEM

PA003 haemocoel (*n.*) A body cavity containing blood. It is an expanded part of the blood system of arthropods and molluscs, in which it is well developed. The viscera are surrounded by the haemocoel which itself connects with sinuses and a simple heart. The blood is returned to the heart from the haemocoel by way of interconnecting sinuses. Unlike a coelom, a haemocoel never has openings to the exterior and never contains sex organs. ↓ BLOOD SINUS ↑ VASCULAR SYSTEM → HEART[1]

PA004 blood sinus (*n.*) **1** An expanded, long cavity without special walls through which blood diffuses back to the heart; found in arthropods where the blood in sinuses bathes the various tissues. **2** A greatly expanded vein found in elasmobranchs, such as sharks. **3** (In mammals) long channels in the skull, situated between the two layers of the dura mater, supplied by blood from veins and conducting venous blood away from the brain. Also called ***venous sinus.*** All the blood sinuses in the skull are interconnecting. ↓ PERICARDIAL SINUS · PERIVISCERAL SINUS · OSTIUM[2] · SINUSOID · PRIMARY BODY CAVITY ↑ HAEMOCOEL → SINUS

PA005 pericardial sinus (*n.*) (In arthropods and molluscs) the blood sinus surrounding the heart; in arthropods blood passes from the pericardial sinus through ostia into the tubular heart. ↑ BLOOD SINUS

PA006 perivisceral sinus (*n.*) The largest blood sinus in an arthropod; it forms the main body cavity. Blood from the

perivisceral sinus passes back into the pericardial sinus and then into the heart. ↑ BLOOD SINUS

PA007 ostium[2] (*n., pl.* **ostia**) (In arthropods) an opening in the wall at the side of any one of the chambers of the tubular heart; it allows blood from the pericardial sinus to pass back into the heart chamber. ↑ BLOOD SINUS → OSTIUM[1]

PA008 sinusoid (*n.*) A small blood-vessel carrying out the function of a capillary in some animal tissues. It differs from a capillary because, ***a*** it is not lined with endothelium; ***b*** it is not a tube with a regular diameter but has an irregular width, sometimes greater than the diameter of a capillary. The walls of a sinusoid usually contain macrophages. Sinusoids are found especially in the liver and in bone marrow. —SINUSOIDAL (*adj.*) ↑ BLOOD SINUS → MACROPHAGE · HEPATIC SINUSOIDS

PA009 primary body cavity (*n.*) Alternative term for HAEMOCOEL (↑). ↑ BLOOD SINUS → COELOMIC SPACE

PA010 blood vessel (*n.*) A tube through which blood flows either to or from the heart; a general term for a conducting vessel for blood, *e.g.* the blood vessels in an earthworm (there are no arteries or veins in earthworms). ↓ ARTERY (H) · VEIN[1] (H) · CAPILLARY[2] (H) · AORTA · VENA CAVA · CARDINAL VEINS · ARTERIAL ↑ VASCULAR SYSTEM

PA011 artery (*n.*) A blood vessel conducting blood from the heart to animal tissues and organs. In vertebrates it is lined with endothelium (smooth flat cells) and surrounded by thick, muscular, elastic walls containing white and yellow fibrous tissue. —ARTERIAL (*adj.*) ARTERIOLE (*n.*) ↓ ARTERIOLE · VEIN[1] (Cn) · VENULE · CAPILLARY[2] ↑ BLOOD VESSEL → HEART[1]

PA012 arteriole (*n.*) In vertebrates, arteries branch repeatedly until their diameter is less than $^1/_3$ mm; they are then called arterioles. Arteriole walls are formed from smooth muscle under the control of the autonomic nervous system. Their function is to control blood supply to the capillaries. ↓ VENULE (Cs) ↑ ARTERY

PA013 vein[1] (*n.*) **1** (In animals) a blood vessel which conducts blood from the tissues and organs back to the heart. In vertebrates, the vein is lined with endothelium (smooth flat cells) and surrounded by muscular and fibrous tissue. The walls are thin and the diameter large compared to an artery. The vein contains valves which allow blood to flow only towards the heart. **2** (In insect wings) one of the fine tubes toughened with cuticle. They provide mechanical support and contain tracheae, nerves, and blood. —VENOUS (*adj.*) VENULE (*n.*) ↑ ARTERY (Cn)

PA014 venule (*n.*) (In vertebrates) a small vein collecting blood from capillaries; it joins other venules to form a vein. A venule has more connective tissue than a capillary muscle. The permeability of the venule wall to blood is similar to that of a capillary wall. ↑ ARTERY · ARTERIOLE (Cn)

PA015 capillary[2] (*n.*) (In animals) a minute hair-like tube (diameter about 5–20 μm) with a wall consisting of a single layer of flattened cells (endothelium); the wall is permeable to substances such as water, oxygen, glucose, amino acids, carbon dioxide, and to inorganic ions. The capillaries form a network in all tissues; they are supplied with oxygenated blood by arterioles and pass deoxygenated blood to venules. Their function is the exchange of dissolved substances between blood and tissue fluid. —CAPILLARY (*n.*) ↑ ARTERY

PA016 aorta (*n.*) (In mammals) the great artery which leaves the left ventricle; it conducts the whole of the arterial blood supply to all parts of the body other than the lungs. In man, it passes blood at the rate of 4 dm^3 per minute. —***aortic*** (*adj.*) ↓ DORSAL AORTA · VENTRAL AORTA · AORTIC ARCHES · SYSTEMIC ARCH ↑ BLOOD VESSEL

PA017 dorsal aorta (*n.*) The artery of vertebrates, other than mammals, passing blood to the rest of the arterial system. In fishes it arises from the branchial arteries which draw oxygenated blood from the gills. ↑ AORTA

PA018 ventral aorta (*n.*) (In fishes) the great artery leading from the conus arteriosus to the aortic arches. ↑ AORTA

PA019 aortic arches (*n.pl.*) (In fishes) the six pairs of arteries connecting the ventral aorta to the dorsal aorta. Each consists of an afferent branchial artery leading from the ventral aorta to a capillary network in a gill. The capillaries lead to an efferent branchial artery which joins the dorsal aorta. These blood vessels form an aortic arch. Six aortic arches are also found in most vertebrate embryos. Several arches become much modified or lost during the development of the circulatory system of the higher vertebrate classes. ↑ AORTA

PA020 systemic arch (*n.*) (In vertebrates other than fishes) the fourth aortic arch which in adults supplies the systemic circulation other than to the head. In adult reptiles and amphibia, both left and right arches are present; in birds only the right arch persists; in mammals only the left arch, which is the aorta, persists. ↑ AORTA

PA021 vena cava (*n., pl.* **venae cavae**) One of the three main veins collecting blood from all over the body of a tetrapod vertebrate. ↓ POSTERIOR VENA CAVA · ANTERIOR VENA CAVA · CAVAL VEINS · POSTCAVAL VEIN · VENA CAVA INFERIOR · PRECAVAL VEIN · VENA CAVA SUPERIOR ↑ BLOOD VESSEL

PA022 posterior vena cava (*n.*) (In tetrapod vertebrates) the main vein collecting blood from all parts of the body posterior to the fore-limbs. It is a single, median vein, entering the right auricle. There is no homologue in fishes. ↑ VENA CAVA

PA023 anterior vena cava (*n.*) (In tetrapod vertebrates) a main vein collecting blood

from the forelimbs and head and entering the right auricle. In many mammals including man there is only one vein on the right; in all other vertebrates there are two veins, one on the right and one on the left. The vein is homologous with a ductus Cuvieri in fishes. ↑ VENA CAVA

PA024 caval veins (*n.pl.*) The posterior vena cavae and the anterior vena cavae. ↑ VENA CAVA

PA025 postcaval vein (*n.*) Alternative term for POSTERIOR VENA CAVA (↑).

PA026 vena cava inferior (*n.*) The posterior vena cava in man, entering the right atrium. ↑ VENA CAVA

PA027 precaval vein (*n.*) Alternative term for ANTERIOR VENA CAVA (↑).

PA028 vena cava superior (*n.*) The anterior vena cava in man, entering the right atrium. ↑ VENA CAVA

PA029 cardinal veins (*n.pl.*) (In fishes) two pairs of main veins, one pair anterior and one pair posterior to the heart, with one vein of each pair on the left or right side. The veins enter a sinus on the right and a sinus on the left. The cardinal veins are present in tetrapod embryos and develop into the venous system. ↓ DUCTUS CUVIERI · CARDINAL SINUSES ↑ BLOOD VESSEL

PA030 ductus Cuvieri (*n., pl.* **ducti Cuvieri**) (In fishes) one of two sinuses, one on each side of the heart. An anterior and a posterior cardinal vein bring blood to the sinus. The blood leaves the ductus Cuvieri to enter the sinus venosus. The ducti Cuvieri of tetrapod embryos develop into the anterior vena cavae of the adult. ↑ CARDINAL VEINS

PA031 cardinal sinuses (*n.pl.*) (In elasmobranchs) the sinuses found at the proximal parts of cardinal veins. ↑ CARDINAL VEINS

PA032 arterial (*adj.*) **1** Of or to do with arteries. **2** Describes the blood flowing in an artery. ↓ VENOUS (Cs) · VENOSE

PA033 venous (*adj.*) Of or to do with veins. ↑ ARTERIAL

PA034 venose (*adj.*) Characterized by many and prominent veins. ↑ ARTERIAL

PA035 circulatory system (*n.*) The closed system of blood vessels which conduct blood and circulate it to all parts of the body. In vertebrates it is divided into the arterial and venous systems and a capillary network. It does not include the lymphatic system, which is an open system. ↓ SYSTEMIC CIRCULATION · PULMONARY CIRCULATION · ARTERIAL SYSTEM · VENOUS SYSTEM · HEPATIC PORTAL SYSTEM · RENAL PORTAL SYSTEM ↑ VASCULAR SYSTEM

PA036 systemic circulation (*n.*) (In mammals) the course of the blood through the whole body beginning with the left ventricle and ending at the right atrium. It excludes the pulmonary circulation to the lungs, the second part of the double circulation. ↑ CIRCULATORY SYSTEM

PA037 pulmonary circulation (*n.*) (In mammals) the course of the blood from the right ventricle through the capillaries of the lungs to the left atrium. ↑ CIRCULATORY SYSTEM

PA038 arterial system (*n.*) The part of the vascular system consisting of arteries and arterioles; it starts with the conus arteriosus in fish, or the aorta in higher vertebrates, and ends at a capillary network. ↑ CIRCULATORY SYSTEM

PA039 venous system (*n.*) The part of the vascular system consisting of tubes or sinuses which conduct blood from the capillaries to the heart; the tubular structures are veins. ↑ ARTERIAL SYSTEM

PA040 hepatic portal system (*n.*) (In vertebrates) the veins from the small intestine and the stomach unite to form the hepatic portal vein. This vein leads to the liver, and the blood in it transports the products of digestion. The portal vein breaks up into capillaries which then reunite and return blood to the systemic circulation by the hepatic vein. ↑ CIRCULATORY SYSTEM → LIVER

PA041 renal portal system (*n.*) In fishes and amphibians the veins from the lower limbs divide into two branches, one branch containing the systemic circulation, and the other branch, the renal vein, going to the kidneys. The renal vein breaks up into capillaries in the kidney; the capillaries reunite and the blood is conducted to the posterior vena cava. ↑ CIRCULATORY SYSTEM → KIDNEY

PA042 heart (*n.*) A hollow, muscular organ containing one or more chambers; it contracts rhythmically to pump blood through blood vessels. Invertebrates, such as earthworms, have especially large blood vessels with muscular walls, called pseudohearts, which pump blood round the body. Arthropods have tubular hearts with many chambers, one in each segment of the thorax and abdomen. Different vertebrate classes have two, three, or four chambered hearts. ↓ SYSTEMIC HEART · PERICARDIAL CAVITY · TRICUSPID VALVE ↑ VASCULAR SYSTEM

PA043 systemic heart (*n.*) **1** (Of invertebrates) the heart. **2** The left atrium and left ventricle of a mammalian heart. ↓ RESPIRATORY HEART · ATRIUM · AURICLE[1] · VENTRICLE[1] · CONUS ARTERIOSUS · SINUS VENOSUS ↑ HEART → SYSTEMIC CIRCULATION

PA044 respiratory heart (*n.*) (In mammals) the right atrium and right ventricle where there is no connection between the right and left sides of the heart. ↑ SYSTEMIC HEART

PA045 atrium (*n.,pl.* **atria**) (In molluscs and vertebrates) a chamber of the heart which receives blood from veins and passes it to a ventricle. It has thin muscular walls and its pumping action is less strong than that of a ventricle. Fishes have one atrium but all other vertebrates have two atria. —***atrial*** (*adj.*) ↓ AURICLE[1] ↑ SYSTEMIC HEART

PA046 auricle[1] (*n.*) Alternative term for ATRIUM (↑). Atrium is preferred in medical and human descriptions. —***auricular*** (*adj.*) ↑ SYSTEMIC HEART

PA047 ventricle[1] (*n.*) (In molluscs and vertebrates) a chamber of the heart which receives blood from an atrium and pumps it out into arteries. In vertebrates and some

molluscs it has thick, muscular walls and its pumping action is powerful. Only mammals, birds, and crocodiles, have two separate ventricles in the heart, all the others have one. —***ventricular*** (*adj.*) ↑ SYSTEMIC HEART

PA048 conus arteriosus (*n.*) (In fishes and amphibians) a muscular cone-shaped structure between the ventricle and the aorta. ↑ SYSTEMIC HEART

PA049 sinus venosus (*n.*) (In vertebrates) a thin-walled, contractile chamber between the caval veins and the atrium; not found in mammals or birds. ↑ SYSTEMIC HEART → PACEMAKER

PA050 pericardial cavity (*n.*) A cavity containing the heart. In vertebrates it is part of the coelom separated from the perivisceral cavity. In arthropods and molluscs it is part of the haemocoel supplying blood to the heart. ↓ PERICARDIUM ↑ HEART → COELOMIC SPACE

PA051 pericardium (*n.*) (In vertebrates) a serous membrane forming the wall of the pericardial cavity. ↑ PERICARDIAL CAVITY → SEROUS MEMBRANE[1]

PA052 tricuspid valve (*n.*) The valve between the right atrium and right ventricle of mammals; it has three membranous flaps. It prevents blood flowing back from ventricle to atrium during ventricular systole. ↓ BICUSPID VALVE · MITRAL VALVE · CHORDAE TENDINEAE · SEMI-LUNAR VALVES · POCKET VALVE ↑ HEART · ATRIUM · VENTRICLE[1]

PA053 bicuspid valve (*n.*) The valve between the left atrium and left ventricle of mammals; it has two membranous flaps. It prevents blood flowing back from ventricle to atrium during ventricular systole. ↑ TRICUSPID VALVE

PA054 mitral valve (*n.*) Alternative term for BICUSPID VALVE.

PA055 chordae tendineae (*n.pl.*) Small cords, like tendons, which connect the membraneous flaps of bicuspid and tricuspid valves to papillary muscles on the walls of a ventricle. ↑ TRICUSPID VALVE

PA056 semi-lunar valves (*n.pl.*) The half-moon shaped valves which open like pockets under pressure from blood in a blood vessel and allow blood to flow in one direction only. They prevent blood flowing back into the heart from the aorta during ventricular diastole and prevent blood flowing backwards in veins. ↑ TRICUSPID VALVE

PA057 pocket valve (*n.*) Alternative term for SEMI-LUNAR VALVE. ↑ TRICUSPID VALVE

PA058 heart beat (*n.*) (In vertebrates) the rhythmic sound of the heart pumping blood. It has a double beat caused by the sound of ventricles contracting, followed by a shorter, sharper sound of the semi-lunar valves closing. The atria do not contribute to the sound of the beat. ↓ SYSTOLE · DIASTOLE · BLOOD PRESSURE · PULSE[2] · PACEMAKER · INNOMINATE ARTERY ↑ HEART

PA059 systole (*n.*) (In vertebrates) the phase of heart beat when the heart muscles contract; there is an atrial systole followed by a ventricular systole. —***systolic*** (*adj.*) ↓ DIASTOLE (Cs) ↑ HEART BEAT

PA060 diastole (*n.*) (In vertebrates) the phase of heart beat when the heart muscles relax; there is an atrial diastole followed by a ventricular diastole when the respective chambers dilate. —***diastolic*** (*adj.*) ↑ HEART BEAT · SYSTOLE (Cs)

PA061 blood pressure (*n.*) The pressure of the blood in main arteries. In man its normal value is between 80 mm and 120 mm of mercury. It varies between the systolic (maximum) pressure and the diastolic (minimum) pressure. The pressure decreases continuously from arteries leaving the heart to veins joining the heart. The pressure is initially caused by the ventricular systole and maintained by the elastic arterial walls. ↑ HEART BEAT

PA062 pulse[2] (*n.*) (In vertebrates) a wave of pressure sent down the arteries by every contraction of the ventricle. The increased pressure can be felt if the artery is pressed against a bone (usually in the wrist). The pressure wave travels much faster than the flow of blood through the artery. The pulse becomes fainter the farther it is from the heart; in the capillaries it has completely disappeared. ↑ HEART BEAT → PULSE[1]

PA063 pacemaker (*n.*) (In vertebrates) the region of the heart where the nervous impulse starting the contraction of the heart muscles is sent out; it is the sinus venosus or the sino-auricular node in the wall of the atrium of birds and mammals. The impulse activates the atria. ↓ BUNDLE OF HIS · ACCELERATOR[1] · INHIBITOR · HEART BLOCK ↑ HEART BEAT → SINUS VENOSUS · NODE

PA064 bundle of His (*n.*) (In vertebrates) a bundle of nerve fibres with muscle fibres; it connects the atria with the ventricles; in mammals it divides to give a branch to each ventricle. Its function is to conduct the impulse of contraction from the atria to the ventricles so as to ensure the harmony of the atria and ventricles in the rhythm of the heart beat. ↑ PACEMAKER

PA065 accelerator[1] (*n.*) A nerve of the sympathetic nervous sytem which increases the rate of heart beat. ↓ INHIBITOR (Cn) ↑ PACEMAKER → SYMPATHETIC NERVOUS SYSTEM

PA066 inhibitor (*n.*) A nerve from the vagus nerve, part of the parasympathetic nervous system; it decreases the rate of heart beat. ↑ PACEMAKER · ACCELERATOR[1] (Cn) → PARASYMPATHETIC NERVOUS SYSTEM

PA067 heart block (*n.*) An abnormal condition of the heart in which the atria and ventricles have different rhythms; it is caused by damage to the bundle of His. ↑ PACEMAKER · BUNDLE OF HIS

PA068 innominate artery (*n.*) (In many birds and mammals) a short artery arising from the aorta; it divides into a subclavian artery and a carotid artery. ↓ SUBCLAVIAN ARTERY · CAROTID ARTERY · JUGULAR VEIN ↑ HEART BEAT → AORTA

PA069 subclavian artery (*n.*) (In tetrapod vertebrates) the proximal part of the main artery going down a fore-limb. ↑ INNOMINATE ARTERY

PA070 carotid artery (*n.*) (In vertebrates) the main artery supplying blood to the head; there is one on each side of the neck. ↑ INNOMINATE ARTERY

PA071 jugular vein (*n.*) (In vertebrates) the main vein returning blood from the head to the systemic circulation. ↑ INNOMINATE ARTERY · HEART BEAT · CIRCULATORY SYSTEM

PA072 lymphatic system (*n.*) **1** (In mammals and birds) a network of thin-walled tubes conducting lymph; the system begins in tissues with small blind-ended tubes which drain into larger tubes and finally lead into the venous blood system. Lymph nodes and other lymphoid organs are distributed over the network. **2** (In other vertebrates) an interconnected system of thin-walled tubes, lymph sinuses and lymph spaces. Animals of this kind possess lymph hearts. Invertebrates do not possess a lymphatic system. ↓ LYMPHATIC[2] · LYMPH SPACE · LYMPHOID ORGAN ↑ VASCULAR SYSTEM → CHYLE · LYMPH

PA073 lymphatic[2] (*n.*) (In mammals and birds) a tube or vessel conducting lymph. It is lined with smooth endothelium and always has thin walls. The larger lymphatics are enclosed by smooth muscle and connective tissue. Lymphatics are either lymph capillaries, lymph vessels, or lymph ducts. ↓ LYMPH CAPILLARIES · LYMPH VESSELS · LYMPH DUCT · LYMPH CHANNEL · LYMPH HEART · RECEPTACULUM CHYLI · LACTEAL ↑ LYMPHATIC SYSTEM

PA074 lymph capillaries (*n.pl.*) Thin-walled, narrow, blind-ended tubes lined with endothelium; they drain tissue fluid from tissue spaces. They form a rich network of tubes corresponding in extent with the blood capillary network. They are highly permeable, allowing foreign particles and bacteria to enter and to be removed by the lymph. Lymph capillaries drain into lymph vessels. ↑ LYMPHATIC[2]

PA075 lymph vessels (*n.pl.*) (In vertebrates) thin-walled tubular vessels resembling veins in structure but with thinner walls and more valves. The walls are enclosed by smooth muscle and connective tissue. Lymph vessels drain into lymph ducts. Lymph vessels act as channels along which pathogens are conducted from infected areas of the body, the pathogens being unable to enter the blood capillaries. In mammals and birds, lymph nodes are distributed along the lymph vessels. The lymph flow is maintained by peristaltic contractility of the lymph vessels aided by the squeezing of the vessels by skeletal muscles, with the valves maintaining a flow in one direction only. In other vertebrates lymph is kept moving by lymph hearts. ↑ LYMPHATIC[2]

PA076 lymph duct (*n.*) The larger lymph vessels join together to form a lymph duct. In mammals and birds there are two thoracic ducts; in man these two ducts drain into the venous system at the base of the neck. ↑ LYMPHATIC[2]

PA077 lymph channel (*n.*) Alternative name for LYMPH VESSEL (↑).

PA078 lymph heart (*n.*) A muscular, expanded part of a lymph vessel, where it opens into a vein. The pulsating, contractile wall pumps lymph in one direction; it is found in vertebrates other than birds and mammals. ↑ LYMPHATIC[2]

PA079 receptaculum chyli (*n.*) A bag-like dilation of the left thoracic duct, located in the abdominal region of mammals. ↑ LYMPHATIC[2]

PA080 lacteal (*n.*) (In vertebrates) a blind-ended lymph capillary in a villus. Fat absorbed by the small intestine enters the lacteal and forms chyle when mixed with lymph. ↑ LYMPHATIC[2] → CHYLE

PA081 lymph space (*n.*) (In amphibia) one of the enlarged lymph vessels forming big spaces in tissues. ↓ LYMPH SAC · LYMPH SINUS ↑ LYMPHATIC SYSTEM

PA082 lymph sac (*n.*) (In amphibia) a space between skin and muscle filled with lymph; the sacs are separated by septa of connective tissue. ↑ LYMPH SPACE

PA083 lymph sinus (*n.*) Alternative name for LYMPH SAC (↑). ↑ LYMPH SPACE

PA084 lymphoid organ (*n.*) A collection or aggregation of lymphoid tissue usually connected to the lymphatic system. ↓ LYMPH NODE · LYMPH GLAND · LYMPH FOLLICLE · SPLEEN · THYMUS ↑ LYMPHATIC SYSTEM → TONSILS

PA085 lymph node (*n.*) An oval or round body consisting of lymphoid tissue; it is found in mammals but is not so well developed in birds; other vertebrates do not possess lymph nodes. Its function is, ***a*** production of lymphocytes and monocytes; ***b*** filtration of lymph to remove pathogens; ***c*** production of antibodies. Macrophages and monocytes remove foreign bodies from lymph; if the foreign bodies are bacteria, the nodes may become inflamed and swollen. ↑ LYMPHATIC[2]

PA086 lymph gland (*n.*) Alternative name for LYMPH NODE. ↑ LYMPHATIC[2]

PA087 lymph follicle (*n.*) An isolated, small patch of lymphoid tissue in the mucous lining of the intestine. ↑ LYMPHOID ORGAN

PA088 spleen (*n.*) A vascular organ composed of lymphoid tissue connected to the circulatory system and not to the lymphatic system. Its functions include, ***a*** production of lymphocytes; ***b*** destruction of red blood cells at the end of their life; ***c*** acting as part of the reticulo-endothelial system in defending the bloodstream against invading pathogens; ***d*** acting as a store of red blood cells. It is found in the abdominal mesenteries of all vertebrates except lampreys and hag-fish (*Agnatha*) —***splenic*** (*adj.*) ↑ LYMPHOID ORGAN

PA089 thymus (*n.*) An irregularly-shaped organ in the neck or thoracic cavity of

vertebrates. In mammals the thymus reaches maximum size at puberty and thereafter slowly atrophies; only a trace is left in older animals. Its function is uncertain but it is thought to be an endocrine gland associated with growth. —***thymic*** (*adj.*) ↑ LYMPHOID ORGAN

Plant Vascular Systems

PB001 vascular tissue (*n.*) A plant tissue that translocates liquids. It consists of specially modified cells, *e.g.* xylem for the conduction of water. ↓ VASCULAR BUNDLE · PROCAMBIUM · AMPHIVASAL · PHLOEM · XYLEM

PB002 vascular bundle (*n.*) A cord-like structure of vascular tissue running longitudinally in the stems and roots of the higher plants; its function is to translocate water and sap to all parts of the plant. Each bundle consists of xylem and phloem, with supporting tissues. In gymnosperms and dicotyledons the vascular bundles of the stem are arranged in a ring round the pith. In monocotyledons and ferns the bundles are scattered throughout the stem tissues. See AMPHICRIBAL BUNDLE, AMPHIVASAL BUNDLE. ↓ COLLATERAL BUNDLE · BICOLLATERAL BUNDLE · CONCENTRIC BUNDLE · AMPHICRIBAL BUNDLE · AMPHIVASAL BUNDLE · OPEN BUNDLE · CLOSED BUNDLE · VEIN[2] ↑ VASCULAR TISSUE

PB003 collateral bundle (*n.*) A vascular bundle in which the phloem and xylem are on the same radius of the plant with the phloem external to the xylem. This is the most common arrangement of phloem and xylem. ↑ VASCULAR BUNDLE

PB004 bicollateral bundle (*n.*) A collateral bundle in which the phloem and the xylem are on the same radius of the plant with phloem both external and internal to the xylem; this is an uncommon arrangement. ↑ VASCULAR BUNDLE

PB005 concentric bundle (*n.*) A vascular bundle with one tissue, either xylem or phloem, surrounding the other. ↑ VASCULAR BUNDLE

PB006 amphicribal bundle (*n.*) A vascular bundle in which phloem surrounds the xylem of a concentric bundle; it occurs in some ferns. ↓ AMPHIVASAL BUNDLE (An) ↑ VASCULAR BUNDLE

PB007 amphivasal bundle (*n.*) A vascular bundle in which xylem surrounds the phloem of a concentric bundle; it occurs in the rhizomes of some monocotyledons. ↑ AMPHICRIBRAL BUNDLE (An)

PB008 open bundle (*n.*) A vascular bundle in which the phloem is separated from the xylem by a thin strip of cambium; growth in the cambium layer provides secondary xylem and secondary phloem; it occurs in most dicotyledons. ↑ VASCULAR BUNDLE

PB009 closed bundle (*n.*) A vascular bundle from which cambium is absent and which has no potential for secondary growth. Each bundle is enclosed in a sheath of sclerenchyma fibres. It occurs in all monocotyledons. ↑ VASCULAR BUNDLE

PB010 vein[2] (*n.*) The vascular bundle of a leaf. ↑ VASCULAR BUNDLE → LEAF

PB011 procambium (*n.*) A tissue of elongated cells in the stem and root, occurring just behind the apical meristem. It gives rise to protophloem, protoxylem and metaxylem, the first vascular tissues. ↓ PROTOPHLOEM · PROTOXYLEM · METAXYLEM ↑ VASCULAR TISSUE

PB012 protophloem (*n.*) The first phloem formed in a vascular bundle, not complex in structure but ready to develop into primary phloem. ↓ PHLOEM ↑ PROCAMBIUM

PB013 protoxylem (*n.*) The first group of vascular bundles of xylem; it is differentiated from cells in procambium. ↓ XYLEM ↑ PROCAMBIUM

PB014 metaxylem (*n.*) Vascular bundles differentiated from procambium after protoxylem; the vessels are wider and have thicker and more lignified walls than protoxylem. In roots the metaxylem is external to the protoxylem; in ferns the metaxylem surrounds the protoxylem. ↓ XYLEM ↑ PROCAMBIUM

PB015 amphivasal (*adj.*) See AMPHIVASAL BUNDLE (↑). ↓ AMPHICRIBRAL

PB016 amphicribal (*adj.*) See AMPHICRIBAL BUNDLE (↑). ↑ AMPHIVASAL

PB017 phloem (*n.*) A type of vascular tissue; in flowering plants it contains sieve-tubes and companion cells supported by ground tissue and also fibres. In gymnosperms and ferns there are no typical sieve-tubes; the phloem cells are elongated and arranged irregularly, not in parallel bundles. The function of the phloem is to conduct food materials, synthesized mainly in the leaves, to all parts of the plant □ *the phloem of a plant can be external to the xylem; phloem is a tissue* ↓ BAST · SIEVE-TUBE ↑ VASCULAR TISSUE

PB018 bast (*n.*) Alternative term for PHLOEM. ↓ BAST CELL · PRIMARY PHLOEM · SECONDARY PHLOEM ↑ PHLOEM

PB019 bast cell (*n.*) A thin-walled, elongated, prosenchymatous cell occurring in sieve-tubes; a mature cell has no nucleus. ↓ SIEVE-TUBE ↑ BAST

PB020 primary phloem (*n.*) Plant tissue formed from procambium by differentiation. ↑ BAST

PB021 secondary phloem (*n.*) Additional tissue added to primary phloem, formed by the activity of the cambium. ↑ BAST

PB022 sieve-tube (*n.*) A long tube-like

structure consisting of bast cells arranged in a longitudinal row, with the cells interconnected by sieve-plates. The sieve-tube of a flowering plant is closely connected in structure and function with a companion cell. The sieve-tube translocates sap from one place to another. ↓ COMPANION CELL · SIEVE-PLATE · CALLUS[2] ↑ PHLOEM

PB023 companion cell (*n.*) In flowering plants, a cell closely associated in origin, position and function with a cell of a sieve-tube. A companion cell has dense protoplasm and a prominent nucleus. A companion cell and a sieve-tube cell are formed by the longitudinal division of one parent cell. It appears to regulate the activity of a sieve-tube. ↑ SIEVE-TUBE

PB024 sieve-plate (*n.*) In flowering plants the end walls of a bast cell are pierced by numerous pores through which pass strands of protoplasm. Sieve-plates connect bast cells in series to form a sieve-tube. In gymnosperms and ferns a structure resembling a sieve-plate is found in the side walls of the bast cells. ↑ SIEVE-TUBE

PB025 callus[2] (*n.*) In temperate and cold climates where plant growth stops during winter the sieve-plates become blocked by a callus, a plug formed from callose. When growth restarts, the callus in some plants is dissolved; in other plants new sieve-tubes are formed and the old sieve-tubes are squashed and forced outwards. ↑ SIEVE-TUBE

PB026 xylem (*n.*) A type of vascular tissue; it contains tubes for the conduction of water and dissolved mineral salts from the roots to the leaves. Two types of tubes occur, tracheids and vessels; these also provide mechanical support for the plant. In trees the xylem occupies almost the entire bulk of stem and root and is known as wood □ *the xylem of a plant can be internal to the phloem; xylem is a tissue* ↓ PRIMARY XYLEM · MEDULLARY RAY · SCALARIFORM ↑ VASCULAR TISSUE → TRACHEID

PB027 primary xylem (*n.*) Plant tissue formed from procambium by differentation; it consists of protoxylem and metaxylem. ↓ SECONDARY XYLEM · XYLEM VESSEL · ANNULAR THICKENING · SPIRAL THICKENING · RETICULATE THICKENING · PITTED THICKENING SCALARIFORM THICKENING · TRACHEA[3] · VESSEL[2] ↑ XYLEM → PROCAMBIUM

PB028 secondary xylem (*n.*) Additional tissue added to primary xylem; it is formed by the activity of the cambium in secondary thickening. ↑ PRIMARY XYLEM

PB029 xylem vessel (*n.*) Formed from xylem cells joined end to end. The walls of the cells are thickened with lignin, the thickening being differently arranged in tissues derived from protoxylem and metaxylem. Xylem cells have lost their protoplasm and are dead. Xylem also contains parenchymatous connective tissue and fibres which give added support. ↑ PRIMARY XYLEM → PROTOXYLEM

PB030 annular thickening (*n.*) Thickening of rings of lignin round the vessels of protoxylem. ↑ PRIMARY XYLEM

PB031 spiral thickening (*n.*) Thickening of a coil of lignin ascending the vessels of protoxylem. ↑ PRIMARY XYLEM

PB032 reticulate thickening (*n.*) Thickening of a network of lignin over the inner surface of a vessel; found in the larger vessels of metaxylem. ↑ PRIMARY XYLEM

PB033 pitted thickening (*n.*) Thickening where the whole of the vessel is lignified except for numerous small pits or pores: found in metaxylem. ↑ PRIMARY XYLEM

PB034 scalariform thickening (*n.*) Thickening where the inner surface of a metaxylem vessel (or a tracheid) is strengthened by bars of lignin in the form of a ladder across the vessel. The bars are known as **trabeculae**. ↑ PRIMARY XYLEM

PB035 trachea[3] (*n.,pl.* **tracheae**) A conducting tube in xylem, thickened annularly or spirally. ↑ PRIMARY XYLEM

PB036 vessel[2] (*n.*) Alternative term for TRACHEA[3]. ↑ PRIMARY XYLEM

PB037 medullary ray (*n.*) A plate of living parenchyma tissue, one to several cells wide, running radially from the inside to the outside of a stem; it runs vertically between vascular bundles or between areas of secondary vascular tissue. Large numbers of medullary rays are present in the vascular cylinder. Their function is to conduct sap between pith and cortex or between intercalary tissues in vascular bundles. Medullary rays form a radial conducting system also used for storage of synthesized food material. ↓ PRIMARY MEDULLARY RAY · SECONDARY MEDULLARY RAY · VASCULAR RAY ↑ XYLEM

PB038 primary medullary ray (*n.*) A medullary ray that passes from pith to cortex, between the vascular bundles ↑ MEDULLARY RAY

PB039 secondary medullary ray (*n.*) A medullary ray formed from cambium during secondary thickening; it ends in secondary xylem or secondary phloem. A secondary medullary ray has no connection with the pith, only with vascular tissue, and hence is sometimes called a ***vascular ray***. ↑ MEDULLARY RAY

PB040 vascular ray (*n.*) Alternative term for a SECONDARY MEDULLARY RAY.

PB041 scalariform (*adj.*) Describes structures or marks situated at regular intervals, shaped like a ladder, *e.g.* tracheids have scalariform thickening. ↑ XYLEM · SCALARIFORM THICKENING

Energy

QA001 energy (*n.*) The capacity to do work, *i.e.* to move a force a certain distance. There are two types of energy. **Kinetic energy** is energy of motion of a body; it is equal to the work the body can do in coming to rest. **Potential energy** is energy of position. For example, a body raised a certain height above the ground has potential energy, as does a stretched spring. The potential energy is equal to the work that the body (or system) can do when it returns to its original position. Energy of moving bodies, stretched springs, etc., is called mechanical energy. Other forms exist, including heat energy, electrical energy, and chemical energy. Each form of energy can be transformed, by suitable means, into another form; transformation can only occur in the presence of matter. The only form of energy that can exist in the absence of matter, *i.e.* in free space, is radiant energy carried by electromagnetic waves. Energy and mass are the two fundamental concepts of the physical world; by the relativity theory, they are shown to be interconvertible. This is the source of energy in a nuclear reactor or in an atomic bomb, called nuclear energy. In the past heat was thought to be different from mechanical energy and was measured in calories. Now all forms of energy are measured in joules □ *the same form of energy is transferred from one place to another place; one form of energy is transformed into another form* —***energetics*** (*n.sing.*) ENERGIZE (*v.*) ***energetic*** (*adj.*) ↓ POTENTIAL[2] · FIELD · ENERGIZE → MAGNETISM · ELECTROSTATICS

QA002 potential[2] (*n.*) One of the factors of energy; it defines the capability of energy to perform work by transformation of energy. In mechanical energy, the potential factor is that of force; if the force is insufficiently great, an object will not be moved and no work will be performed. In heat energy, the potential factor is temperature; if the temperature is insufficiently high, a chemical reaction will not take place, or a change of state will not occur. In electrical energy, the potential factor is the electromotive force; the voltage must exceed the striking potential for a discharge tube. In radiant energy, the frequency is the potential factor; if the frequency is too low, the photoelectric effect will not take place. Potential determines the ability to surmount an energy barrier. ↓ CAPACITY · ENERGY BARRIER ↑ ENERGY → STRIKING POTENTIAL · PHOTOELECTRIC EFFECT

QA003 capacity (*n.*) A measure of the ability of energy to do work, the complementary factor to potential. In mechanical energy it is the distance a force moves its point of application. In heat energy it is measured by entropy. In electrical energy it is measured by the quantity of charge. In radiant energy it is measured by the number of quanta.
Quantity of energy = potential × capacity. ↑ POTENTIAL[2]

QA004 energy barrier (*n.*) An amount of energy that must be supplied to activate a system. If a lesser amount of energy is supplied, nothing happens. The effects of energy barriers are seen in many phenomena. For example, ***a*** the activation energy of chemical reactions; ***b*** the work function of solids in the photoelectric effect; ***c*** the striking potentials of electric discharges □ *the energy barrier must be surmounted before the reaction takes place* ↑ POTENTIAL[2]

QA005 field (*n.*) A region in which a force is exerted; the force originates from a source at a point in the field. Types of field include, ***a*** a magnetic field arising from a magnet or electric current at the centre of the field; ***b*** an electric field arising from a point charge, or from a charged conductor; ***c*** a gravitational field arising from a massive body. A field is usually defined in terms of the effect on a suitable body placed in the field; it is usually represented by vector lines, as the field is defined as a vector quantity. Many fields exhibit a decreasing intensity with distance, which is measured by an inverse square law. ↓ FLUX[1] · INVERSE SQUARE LAW ↑ ENERGY

QA006 flux[1] (*n.*) In general, the rate of flow of anything. For example, ***a*** the rate of flow of a fluid; ***b*** the rate at which elementary particles flow (equal to the number per unit volume multiplied by their average velocity); ***c*** the rate of passage of energy through a given surface area. Flux is also used to measure vector quantities acting through an area. For example, the magnetic flux measures the strength of a magnetic field. ↑ FIELD

QA007 inverse square law (*n.*) A law which states that the effect of a source A at a point B varies inversely as the square of the distance AB. Examples of the law include, ***a*** the force due to a magnetic pole; ***b*** the force due to an electric charge; ***c*** the illumination on a surface; ***d*** gravitational force; ***e*** the intensity of radiation. ↑ FIELD

QA008 energize (*v.t.*) To put energy into a device, so that it operates, *e.g.* a radio aerial is energized by reception of electromagnetic waves. ↑ ENERGY → ACTIVATE

Magnetism

QB001 magnetism (*n.*) **1** The property of producing, or being affected by, magnetic fields. **2** The study of magnets and effects of magnetic fields. ↓ MAGNET · MAGNETIZATION · MAGNETOSTRICTION · MAGNETOMETER · MAGNETIZE · MAGNETIC · LIKE[2] · TERRESTRIAL MAGNETISM · MAGNETIC CIRCUIT → ENERGY

QB002 magnet (*n.*) An object that produces a magnetic field. There are two types: permanent and temporary magnets. A **permanent magnet** is made from a ferromagnetic substance and has a permanent magnetic field associated with it, as well as possessing a magnetic moment. A **temporary magnet** is a piece of ferromagnetic substance which acts as a magnet so long as it is in the magnetic field of a conductor carrying an electric current. ↓ POLE[2] · POLARITY[1] · MAGNETIC POLE STRENGTH · MAGNETIC AXIS · MAGNETIC LENGTH · MAGNETIC MOMENT · MAGNETIC NEEDLE ↑ MAGNETISM

QB003 pole[2] (*n.*) One of two points in a magnet which the lines of force of its magnetic field either converge on or diverge from. The resultant attractive or repulsive force of one magnet for another appears to be concentrated at the poles of the magnets. Any two poles are described as *like* or *unlike*. —POLARITY (*n.*) ↓ LIKE[2] ↑ MAGNET

QB004 polarity[1] (*n.*) The condition of possessing different poles, and of possessing different properties associated with those poles, *e.g.* ***a*** the polarity of a magnet depends on which end is a north pole and which a south pole; ***b*** the polarity of a cell terminal is either positive or negative □ *to reverse the polarity* ↑ MAGNET

QB005 magnetic pole strength (*n.*) For a very long bar magnet, the magnetic pole strength is equal to the magnetic flux emerging from its ends; the pole strength is measured in webers. For ordinary bar magnets, the poles interact on each other, and the emerging flux is usually less than the pole strength. An alternative definition is that a magnetic pole has a strength of unity if it repels a like pole placed 1 metre away in a vacuum with a force of 1 newton. ↑ MAGNET → MAGNETIC FLUX

QB006 magnetic axis (*n.*) A line joining the two poles of a magnet. ↑ MAGNET

QB007 magnetic length (*n.*) The distance between the poles of a permanent magnet. For a bar magnet it is approximately 5/6 of the physical length. ↑ MAGNET

QB008 magnetic moment (*n.*) The couple required to hold a magnet at right angles to a magnetic field of unit intensity, or unit magnetizing force, *i.e.* 1 ampere per metre. For a permanent magnet, the magnetic moment is equal to the magnetic pole strength multiplied by the magnetic length. Magnetic moment is measured in weber-metres. Magnetic moment is sometimes given the symbol M; recent changes favour using the symbol for a couple (C) or for a torque (T). ↑ MAGNET → COUPLE · TORQUE

QB009 magnetic needle (*n.*) A thin magnetized rod of steel, which is freely suspended so that it comes to rest in the magnetic meridian. ↑ MAGNET

QB010 magnetization (*n.*) **1** The process of changing a ferromagnetic specimen into a permanent magnet. **2** The extent to which a specimen has been made magnetic; it is measured by the magnetic polarization achieved by the magnetizing field. ↓ MAGNETIC FORCE · MAGNETIC SHIELDING · KEEPER · MAGNETIC FIELD[1] · NEUTRAL POINT ↑ MAGNETISM → FERROMAGNETIC

QB011 magnetic force (*n.*) The force exerted by a magnetic field on a magnetic pole or a moving electric charge; the force is either attractive or repulsive, and obeys the inverse square law. ↑ MAGNETIZATION

QB012 magnetic shielding (*n.*) Enclosing an object, such as an instrument, in a thick-walled case of mu-metal or Ni/Fe alloy, to shield or screen the object from external magnetic fields, so that the magnetic fields do not affect the object. ↑ MAGNETIZATION

QB013 keeper (*n.*) A small piece of soft iron placed across the ends of a pair of permanent bar magnets, with the magnets arranged with unlike poles adjacent. Keepers form a closed chain of the magnetic field and prevent the magnets undergoing self-demagnetization, otherwise permanent magnets slowly lose their strength. ↑ MAGNETIZATION

QB014 magnetic field[1] (*n.*) A field of force which exists at a point if a small magnet placed at that point experiences a couple. A magnetic field is formed by a permanent magnet or by a circuit carrying an electric current. ↑ MAGNETIZATION

QB015 neutral point (*n.*) A point in a magnetic field at which there is no resultant magnetic force. ↑ MAGNETIZATION

QB016 magnetostriction (*n.*) The effect in which magnetization of a ferromagnetic material makes the piece longer and thinner; the change in shape is extremely small. ↓ CURIE POINT · MAGNETIC DOMAIN ↑ MAGNETISM

QB017 Curie point (*n.*) The temperature at which a material loses its ferromagnetic properties. ↑ MAGNETOSTRICTION → FERROMAGNETIC

QB018 magnetic domain (*n.*) In a ferromagnetic material, a series of domains, or regions, exist. In any one domain, all the atoms are aligned with their magnetic axes in one direction; this direction varies from one domain to another in such a way that the domain axes form closed loops. If an external magnetic field is applied, the magnetic moments of the domains, but not the domains themselves, are aligned by the

external field, so that they are parallel; the domain boundaries shift to accomplish this effect. The ferromagnetic material then forms a permanent magnet. ↑ MAGNETOSTRICTION

QB019 magnetometer (*n.*) An instrument for comparing the intensities of magnetic fields or for comparing magnetic moments. A very short bar magnet, attached at right angles to a long pointer, is pivoted in a compass box. The deflections of the magnet are indicated by the pointer on a circular scale. In comparing magnetic moments, a null-method is employed whereby the magnetometer is at a neutral point of the two magnetic fields associated with the magnetic moments. ↓ VIBRATION MAGNETOMETER ↑ MAGNETISM → NULL

QB020 vibration magnetometer (*n.*) An apparatus used to determine the intensity of a magnetic field, or to compare the intensities of two magnetic fields. A permanent magnet is allowed to execute angular oscillations about its equilibrium position. The period of oscillation depends on the intensity of the magnetic field (*H*), the moment of inertia (*I*) and on the magnetic moment (*M*) of the magnet. The period of oscillation (*T*) is given by:

$$T = 2\pi\sqrt{\frac{I}{MH}}$$

↑ MAGNETOMETER → MAGNETIC POLARIZATION

QB021 magnetize (*v.t.*) To change a piece of ferromagnetic substance into a magnet, either permanent or temporary. This can be done, ***a*** by using a permanent magnet; ***b*** by using the magnetic field of an electric circuit. The term implies the production of a permanent magnet. —MAGNETIZATION (*n.*) MAGNETIZED (*adj.*) ↓ DEMAGNETIZE (An) ↑ MAGNETISM

QB022 demagnetize (*v.t.*) To destroy the magnetic properties of a magnet. —***demagnetization*** (*n.*) ***demagnetized*** (*adj.*) ↑ MAGNETIZE (An)

QB023 magnetic (*adj.*) To do with or having the properties of a magnet. ↓ MAGNETIZED · UNMAGNETIZED · SOFT[2] · HARD ↑ MAGNETISM

QB024 magnetized (*adj.*) Describes a state of a ferromagnetic specimen when some or all the magnetic domains have their axes aligned parallel, and the specimen behaves as a permanent magnet. ↓ UNMAGNETIZED (An) ↑ MAGNETIC · MAGNETIC DOMAIN → MAGNETIC SATURATION (H)

QB025 unmagnetized (*adj.*) Describes a state of a ferromagnetic specimen in which the magnetic fields of the domains cancel out, and virtually no external magnetic field can be detected. ↑ MAGNETIC · MAGNETIZED (An)

QB026 soft[2] (*n.*) Describes ferromagnetic materials which are easy to magnetize, but readily lose their magnetic properties. ↓ HARD (Ag) ↑ MAGNETIC → RELUCTANCE

QB027 hard (*adj.*) Describes ferromagnetic materials which are difficult to magnetize but retain their magnetic properties. ↑ MAGNETIC · SOFT[2] (Ag)

QB028 like[2] (*adj.*) A pole of a magnet is either north-seeking (a north pole) or south-seeking (a south pole). Two north poles are like poles, two south poles are also like poles. Like poles repel each other. ↓ UNLIKE[2] (An) · CONSEQUENT ↑ MAGNETISM → POLE[2]

QB029 unlike[2] (*adj.*) Describes one north-pole and one south-pole of a magnet. A north pole attracts a south pole, *i.e.* two unlike poles attract each other. ↑ LIKE[2] (An)

QB030 consequent (*adj.*) Describes the poles of a magnet when there are two like poles at each end, and an unlike pole in the middle of the magnet. ↑ LIKE[2]

QB031 terrestrial magnetism (*n.*) The magnetic field possessed by the Earth; also the study of this field. The cause of this magnetic field is not definitely known; it varies with the locality on the Earth's surface and also with time, the changes being either secular or diurnal. The Earth's magnetic field is similar to the field which would be produced by a powerful magnet situated at the centre of the Earth and in the direction of the magnetic north and south poles on the Earth's surface. ↓ MAGNETIC MERIDIAN · MAGNETIC ELEMENTS · ISOGONAL · SUNSPOT · COMPASS · SECULAR ↑ MAGNETISM

QB032 magnetic meridian (*n.*) At any given point, the vertical plane which contains the direction of the Earth's magnetic field at that point. ↓ GEOGRAPHICAL MERIDIAN · MAGNETIC DECLINATION · MAGNETIC VARIATION ↑ TERRESTRIAL MAGNETISM

QB033 geographical meridian (*n.*) At any given point, a plane containing the point and the Earth's axis of rotation. ↑ MAGNETIC MERIDIAN

QB034 magnetic declination (*n.*) The angle between the magnetic meridian and the geographical meridian. ↑ MAGNETIC MERIDIAN

QB035 magnetic variation (*n.*) Alternative term for MAGNETIC DECLINATION.

QB036 magnetic elements (*n.pl.*) The three quantities, magnetic declination, magnetic dip, and horizontal intensity, which together completely define the Earth's magnetic field at any given point. ↓ MAGNETIC DIP · ANGLE OF DIP · INCLINATION[2] ↑ TERRESTRIAL MAGNETISM

QB037 magnetic dip (*n.*) The angle between the direction of the Earth's magnetic field, at any given point, and the horizontal. ↑ MAGNETIC ELEMENTS

QB038 angle of dip (*n.*) Alternative term for MAGNETIC DIP

QB039 inclination[2] (*n.*) Alternative term for MAGNETIC DIP.

QB040 isogonal (*n.*) A line joining all the points on the Earth's surface which have identical magnetic declinations. ↓ AGONIC LINE (H) · ISOCLINAL · MAGNETIC EQUATOR · ACLINIC LINE · ISODYNAMIC LINE ↑ TERRESTRIAL MAGNETISM

QB041 agonic line (*n.*) A line joining all the points on the Earth's surface where the magnetic declination is zero. ↑ ISOGONAL

QB042 isoclinal (*n.*) A line joining all points on the Earth's surface which have identical magnetic dip. ↓ MAGNETIC EQUATOR (H) ↑ ISOGONAL

QB043 magnetic equator (*n.*) A line joining all points on the Earth's surface where the magnetic dip is zero; it lies fairly near the geographical equator. ↑ ISOGONAL

QB044 aclinic line (*n.*) Alternative term for the MAGNETIC EQUATOR.

QB045 isodynamic line (*n.*) A line joining all the points on the Earth's surface which have identical horizontal intensities of the Earth's magnetic field. ↑ ISOGONAL

QB046 sunspot (*n.*) An area of the surface of the sun which is darker in appearance than the rest of the surface. The appearance of sunspots is spasmodic, but the number of sunspots is at a maximum approximately every eleven years. Their appearance is associated with changes in the Earth's ionosphere, causing radio static, with magnetic storms, and other natural phenomena. ↓ MAGNETIC STORM · MAGNETIC CYCLE ↑ TERRESTRIAL MAGNETISM

QB047 magnetic storm (*n.*) A sudden violent disturbance in the Earth's magnetic field affecting the magnetic elements. Compasses are affected, and radio transmission is affected. ↑ SUNSPOT

QB048 magnetic cycle (*n.*) (Of the sun) a period of 23 years, based on the appearance of sunspots. Sunspots generally appear in pairs, moving in opposite directions, clockwise, and anticlockwise, round the sun. The maximum number of sunspots appears approximately every eleven years, but the directions of movement are opposite every eleven years. The magnetic cycle is the period of time between two successive maxima moving in the same direction, *i.e.* 23 years. ↑ SUNSPOT

QB049 compass (*n.*) A magnetic compass consists of a freely pivoted magnetic needle, which rotates in a horizontal plane. The ends point to a circular scale marked with North, South, East and West, and intermediate points (called the points of the compass). ↓ DIP CIRCLE · EARTH INDUCTOR ↑ TERRESTRIAL MAGNETISM

QB050 dip circle (*n.*) An instrument for measuring magnetic dip. It consists of a magnetic needle pivoted so that it moves in a vertical plane. The angle is measured by a vertical scale. ↑ COMPASS

QB051 Earth inductor (*n.*) An apparatus for measuring the Earth's field. A coil of large area, and many turns, is rotated in the Earth's magnetic field, either about a horizontal axis, or about a vertical axis. The induced e.m.f. is measured to determine the magnetic flux through the coil. The horizontal intensity or the vertical intensity of the Earth's magnetic field is then calculated. ↑ COMPASS

QB052 secular (*adj.*) Describes a very slow change in the Earth's magnetic field. The secular change is cyclic in nature with a period of about 960 years for completion of the cycle, *e.g.* at Greenwich the magnetic declination was zero in A.D. 1659; it increased to a maximum of 24°30′ west of north in A.D. 1820; it should again have a declination of 0° about A.D. 2139. This is 480 years for a half cycle, as after A.D. 2139 the magnetic declination will increase to a maximum of 24°30′ east of north and then return to zero. ↓ DIURNAL^2 ↑ TERRESTRIAL MAGNETISM

QB053 diurnal^2 (*adj.*) Designating much smaller and more rapid changes in the Earth's magnetic field than secular changes. Diurnal changes have been shown to be associated with changes in the ionosphere connected with the appearance of sunspots. ↑ SECULAR

QB054 magnetic circuit (*n.*) When a magnetic flux is effectively confined to one or more closed loops of ferromagnetic materials, the loops form magnetic circuits, *e.g.* the magnetic system in the core of a transformer forms a magnetic circuit. ↓ MAGNETIC POLARIZATION · HYSTERESIS · REMANENCE ↑ MAGNETISM

QB055 magnetic polarization (*n.*) The magnetic moment per unit volume; also the flux per unit area of cross-section. A specimen, a material, or a medium can be considered. Magnetic polarization is given the symbol J; it is measured in tesla. ↓ INTENSITY OF MAGNETIZATION · RELUCTANCE · RELUCTIVITY · MAGNETOMOTIVE FORCE · MAGNETIC POTENTIAL · M.M.F. ↑ MAGNETIC CIRCUIT

QB056 intensity of magnetization (*n.*) The old name for MAGNETIC POLARIZATION.

QB057 reluctance (*n.*) The property of a piece of material to resist the passage of a magnetic flux through it. If l is the length of the piece of material, A is its cross section, and μ is the permeability of the material, then reluctance is $\frac{l}{\mu A}$, and is measured in amperes per weber. Reluctance depends on the physical dimensions and reluctivity of the material. ↑ MAGNETIC POLARIZATION

QB058 reluctivity (*n.*) The property of a material to resist a magnetic flux passing through it. It is the reciprocal of the permeability of the material, which measures the ease with which a magnetic flux can pass through. Reluctivity is measured by $\frac{1}{\mu}$, where μ is the permeability. As permeability can vary with the magnetic history of the material, reluctivity is not a constant quantity for any given material. ↑ MAGNETIC POLARIZATION

QB059 magnetomotive force (*n.*) A concept similar to electromotive force for driving a magnetic flux round a magnetic

circuit:
magnetomotive force = flux × reluctance. Flux is measured in weber-turns and reluctance in amperes per weber, hence magnetomotive force is measured in ampere-turns. The flux (N) in the magnetic circuit should be constant for any calculation using the equation, and there is often flux leakage; even so, it is a sufficiently accurate relationship for many practical applications. Magnetomotive force is given the symbol Fm:

$$Fm = N\frac{l}{\mu A} \text{ for a magnetic circuit.}$$

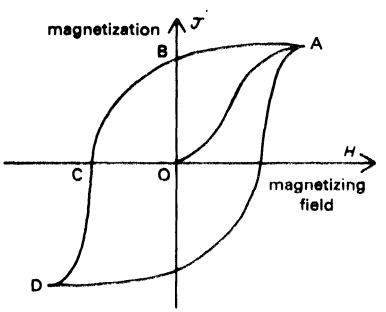
↑ MAGNETIC POLARIZATION · RELUCTANCE

QB060 magnetic potential (*n.*) The magnetic potential at any point P in a uniform magnetic field is defined as the work done in bringing unit north pole from infinity to the point P. The concept is analogous to electrical potential. The difference in magnetic potential between two points is defined as the work done in taking unit north pole from one point to the other. ↑ MAGNETIC POLARIZATION

QB061 m.m.f. (*abbr.*) Abbreviation for MAGNETOMOTIVE FORCE (↑). ↑ MAGNETIC POLARIZATION

QB062 hysteresis (*n.*) An effect observed in the magnetic and elastic behaviour of materials; it is a physical phenomenon. On applying force to the material, a polarization or strain is produced. When the force is reduced, the polarization or strain lags behind in reduction. This lag in the effect behind the force is called hysteresis. ↓ HYSTERESIS CYCLE · HYSTERESIS LOOP · HYSTERESIS LOSS · DEGAUSSING ↑ MAGNETIC CIRCUIT

QB063 hysteresis cycle (*n.*) A complete cycle of variation of a magnetizing field, from maximum effect in one direction to maximum effect in the opposite direction, and a return to complete the cycle. The corresponding magnetization is plotted to form a curve as shown in the diagram. An unmagnetized specimen starts at O. At point A, the specimen is magnetically saturated. When the magnetizing field is reduced to zero, the magnetization falls, but is not far below magnetic saturation; this is the point of remanence B. A strong magnetizing field is required to reduce the magnetization to zero, at point C. Magnetic saturation in the reverse direction is achieved at D. ↑ HYSTERESIS



HYSTERISIS CYCLE

QB064 hysteresis loop (*n.*) The enclosed shape of a hysteresis curve. ↑ HYSTERESIS

QB065 hysteresis loss (*n.*) Rapid alterations of a current cause an iron core in an electrical device to pass through a hysteresis cycle; energy is lost as heat from the iron core. The energy loss is proportional to the area enclosed by the hysteresis loop. To reduce the area of a hysteresis loop, various alloys of iron are used. ↑ HYSTERESIS

QB066 degaussing (*n.*) **1** A method of demagnetizing a magnet, or magnetized specimen, by placing the object in a solenoid and subjecting it to an alternating current of decreasing strength. The hysteresis loops produced by this method are of ever-decreasing size until the specimen is completely demagnetized. **2** Neutralizing a magnetic field by setting up an equal opposing field. —***degauss*** (*v.*) ↑ HYSTERESIS

QB067 remanence (*n.*) The residual magnetism in a ferromagnetic specimen after the magnetizing field has been reduced to zero. In the hysteresis cycle it is point B. ↓ COERCIVE FORCE · MAGNETIC SATURATION · MAGNETIC SUSCEPTIBILITY · CURIE'S LAW · COERCIVITY ↑ MAGNETIC CIRCUIT

QB068 coercive force (*n.*) The strength of the magnetizing field required to reduce the magnetization of a magnet to zero is called the coercive force; it is the point C on the hysteresis cycle. ↑ REMANENCE

QB069 magnetic saturation (*n.*) The state of a ferromagnetic specimen when all the magnetic domains have been aligned, and an increase in the strength of the magnetizing field produces no further magnetization of the specimen. ↑ REMANENCE → MAGNETIC DOMAIN

QB070 magnetic susceptibility (*n.*) The ratio of the magnetic polarization divided by the magnetic flux density; it is given the symbol X_m. For soft magnetic materials, the magnetic susceptibility is almost constant for varying values of H, the magnetizing field, so:

$$J = X_m \mu_0 H.$$

For hard magnetic materials, X_m varies with H. The relative permeability (μ_r) and the magnetic susceptibility are connected by:

$$\mu_r = 1 + X_m$$

In ferromagnetic materials, $X_m \gg 1$, so $\mu_r \simeq X_m$. ↑ REMANENCE

QB071 Curie's law (*n.*) The magnetic susceptibility of a paramagnetic substance is inversely proportional to the thermodynamic temperature. ↑ REMANENCE → CURIE POINT

QB072 coercivity (*n.*) The coercive force required to demagnetize a specimen that is saturated. ↑ REMANENCE

Electrostatics

QC001 electrostatics (*n. sing.*) The study of static electric charges. ↓ ELECTROSTATIC FORCE · ELECTRIC FIELD · POINT DISCHARGE · ELECTROSCOPE · POSITIVE[2] · DIELECTRIC · DIPOLE[1] → ENERGY

QC002 electrostatic force (*n.*) The force that exists between two electric charges; a force of attraction exists between unlike charges and a force of repulsion between like charges. The electrostatic force obeys the inverse square law, and is proportional to the product of the electric charges. ↓ CHARGE DENSITY · COULOMB'S LAW ↑ ELECTROSTATICS → ELECTRIC CHARGE

QC003 charge density (*n.*) The charge density, symbol σ (the Greek letter sigma), on the surface of a conductor is the charge (Q) carried per unit area (A).

$$\sigma = \frac{Q}{A}$$

↑ ELECTROSTATIC FORCE

QC004 Coulomb's law (*n.*) The force of attraction or repulsion between two electric charges is proportional to the magnitude of the charges and inversely proportional to the square of the distance between them:

$$F \propto \frac{Q_1 Q_2}{r^2}$$

↑ ELECTROSTATIC FORCE

QC005 electric field (*n.*) A region in which an electric charge would move under an electrostatic force. An electric field arises from an electric charge; it can be described by lines of force. The magnitude of an electric field is measured by its intensity. ↓ ELECTROSTATIC POTENTIAL · EQUIPOTENTIAL · POTENTIAL GRADIENT · ELECTRIC INTENSITY · FLUX[2] · FLUX DENSITY[2] · ELECTRON-VOLT ↑ ELECTROSTATICS → LINE OF FORCE

QC006 electrostatic potential (*n.*) The electrostatic potential at a point is the work done against the forces of the electric field in bringing unit positive charge from a point at zero potential to the point. ↑ ELECTRIC FIELD → POTENTIAL[2]

QC007 equipotential (*adj.*) Describes points in an electric field which are at the same electrostatic potential. All equipotential points in a field, when joined together, form an equipotential line or surface. A diagram, showing equipotential surfaces, provides a description of an electric field which is complementary to a description by lines of force. Lines of force are perpendicular to equipotential surfaces. ↑ ELECTRIC FIELD

QC008 potential gradient (*n.*) The rate of change of potential with distance; the term is usually applied to electric fields, but can be applied to a conductor as well. For a uniform potential gradient, the drop in potential (V) over a distance (x) gives a gradient of $\frac{V}{x}$. For non-uniform gradients, the potential gradient at any point is given by $\frac{dV}{dx}$ (using the calculus notation). ↑ ELECTRIC FIELD

QC009 electric intensity (*n.*) The intensity of an electric field (symbol E), at a point, is the force per unit charge on a positive electric charge placed there. A force, F, acting on a charge, Q, is given by:

$$F = QE.$$

An electric field can also be described by the potential at each point of it. If the potential at any point changes at a rate of $\frac{dV}{dx}$ with respect to distance, then:

$$E = -\frac{dV}{dx}$$

Electric intensity is usually expressed in volts per metre. (It could also be expressed in newtons per coulomb.) ↑ ELECTRIC FIELD

QC010 flux[2] (*n.*) The flux of an electric field through a small plane surface is the product of the area of the surface and the component of the flux density normal to it. ↑ ELECTRIC FIELD

QC011 flux density[2] (*n.*) The flux density of an electric field at a point is the product of the absolute permittivity of the medium and the electric intensity at that point. The symbol for flux density is D:

$$D = \varepsilon E$$

where ε is absolute permittivity and E is electric intensity. Also called ***electric displacement.*** ↑ ELECTRIC FIELD → ELECTRIC DISPLACEMENT

QC012 electron-volt (*n.*) A unit of energy outside SI units, but of convenience in many electronic calculations. The electron-volt is the quantity of energy gained by an electron in falling through a p.d. of 1 volt. If e is the charge on an electron, then:

$$\begin{aligned} 1 \text{ electron-volt} &= 1 \text{ eV} \\ &= 1{\cdot}6 \times 10^{-19} \times 1 \text{ joule} \\ &= 1{\cdot}6 \times 10^{-19} \text{ joule.} \end{aligned}$$

↑ ELECTRIC FIELD

QC013 point discharge (*n.*) The charge density of a conductor is very high at a sharp point, or at any pointed part, and gaseous ions are repelled violently. This carries away charge from the conductor, and gives rise to an **electric wind**. An object placed in the path of the electric wind may collect electric charge. Because point discharge tends to discharge a conductor, all electrical apparatus at a high potential is designed with gently curving or rounded smooth surfaces. ↓ CORONA DISCHARGE · ELECTRIC WIND · ELECTROSTRICTION ↑ ELECTROSTATICS

QC014 corona discharge (*n.*) **1** A luminous discharge appearing round the surface of a charged conductor when the voltage

gradient is sufficiently high to cause ionization of the air. **2** Alternative term for POINT DICHARGE (↑).

QC015 electric wind (*n.*) During point discharge from a conductor, ions in the air which have the same charge as the conductor are repelled violently; this gives rise to an appreciable electric wind. Any object placed in the path of the wind may collect charge on its surface. ↑ POINT DISCHARGE

QC016 electrostriction (*n.*) The effect of an electric field on a dielectric; an alteration in the size of dielectrics takes place when a p.d. is applied. The direction of the p.d. determines whether the material expands or contracts. This effect is the reverse of the piezoelectric effect. ↑ POINT DISCHARGE

QC017 electroscope (*n.*) An instrument for detecting or measuring electric charge. The common type is the gold-leaf electroscope, used for detecting the presence of an electric charge. It consists of a rectangular piece of fine gold leaf attached to the flattened surface of a brass rod. The rod is mounted in a case, with an insulating plug, and has a brass cap on the top. Placing an electric charge on the brass cap causes the gold leaf to diverge, owing to repulsion from like charges. ↓ ELECTROSTATIC GENERATOR · ELECTROPHORUS · VAN DE GRAAFF GENERATOR · PROOF-PLANE ↑ ELECTROSTATICS → ELECTROMETER

QC018 electrostatic generator (*n.*) A device for the continuous separation of electric charges. Such devices produce high potentials, but a small quantity of charge. ↑ ELECTROSCOPE

QC019 electrophorus (*n.*) A device for producing electric charge by electrostatic induction. It consists of a metal plate with an insulated handle and a flat plate of an insulator. The insulator is charged and the metal plate is placed on it and then earthed. The metal plate is removed and now carries an induced charge of opposite sign. ↑ ELECTROSCOPE

QC020 Van de Graaff generator (*n.*) An electrostatic generator. It consists of a rubberized silk belt driven by a motor inside an insulating support column. Positive charge is sprayed on the belt by point discharge from a row of points. This charge is carried up to a hollow conductor, where positive charges are induced on the outside spherical shape. Large quantities of charge are built up and p.d.'s of up to 10^7 volts can be obtained. ↑ ELECTROSCOPE

QC021 proof-plane (*n.*) A small metal plate with an insulating handle; it is used to remove electric charge from a conductor to test the charge. ↑ ELECTROSCOPE

QC022 positive² (*adj.*) Describes an electric charge produced by friction on a glass rod; now known as the type of electric charge on a proton. ↓ NEGATIVE² (P) · ELECTROSTATIC ↑ ELECTROSTATICS

QC023 negative² (*adj.*) Describes an electric charge produced by friction on an ebonite rod; now known as the type of electric charge on an electron. ↑ POSITIVE² (P)

QC024 electrostatic (*adj.*) Of or to do with electric charges that remain stationary and do not flow as in an electric current. ↑ POSITIVE²

QC025 dielectric (*n.*) An insulating medium placed in an electric field is called a dielectric. An electric current cannot pass through a dielectric, but an electric field can pass through. There is no net flow of charge but only a displacement of electric charge. The electrons and positive nuclei are bound in the crystal lattice, and cannot move away; they are capable of small displacements. When an electric field is applied to the dielectric, the bound charges are slightly displaced. —DIELECTRIC (*adj.*) ↓ DIELECTRIC LOSS · PERMITTIVITY · CAPACITOR · CAPACITATIVE ↑ ELECTROSTATICS

QC026 dielectric loss (*n.*) The loss of electrical energy when a dielectric is subjected to an alternating p.d.; it arises from the vibrations caused by displacement of the bound charged particles. ↓ DIELECTRIC STRENGTH · DIELECTRIC FATIGUE · DIELECTRIC HEATING ↑ DIELECTRIC

QC027 dielectric strength (*n.*) The maximum potential gradient that can be applied to a dielectric substance without its insulating properties breaking down; usually expressed in volts mm^{-1}. ↑ DIELECTRIC LOSS

QC028 dielectric fatigue (*n.*) The loss of the insulating properties of a dielectric after undergoing continuous electrical stress for a period of time. ↑ DIELECTRIC LOSS

QC029 dielectric heating (*n.*) If electrically insulating material, *i.e.* a dielectric, is in an alternating electric field, the material is heated by energy lost from the field to electrons in the atoms or molecules of the material. ↑ DIELECTRIC LOSS

QC030 permittivity (*n.*) The effect of an insulating medium between two electric charges is to reduce the force between the charges; this gives rise to a property of a medium called its permittivity. Two electric charges, Q_1 and Q_2, in a vacuum, at a distance d apart, attract each other with a force F. To equate these values, the concept of permittivity of a vacuum is required. To simplify other calculations, the equation is rationalized by including a factor of 4π in the denominator. The equation then becomes:

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 d^2}$$

where ε_0 (the Greek letter epsilon) is the permittivity of a vacuum. The units of ε_0 are coulomb² newton^{-1} metre^{-2}, but now the constant is given in farad metre^{-1}. The value calculated for ε_0 from above is its rationalized value, $\varepsilon_0 = 8{\cdot}84 \times 10^{-12}$ farad metre^{-1}. ↓ RELATIVE PERMITTIVITY · ABSOLUTE PERMITTIVITY · ELECTRIC SPACE CONSTANT · DIELECTRIC CONSTANT · SPECIFIC INDUCTIVE CAPACITY ↑ DIELECTRIC

QC031 relative permittivity (*n.*) The force

between two electric charges is reduced by a factor ϵ_r when a dielectric is introduced to replace a vacuum. This factor is the relative permittivity; it is also called ***dielectric constant*** but relative permittivity is now more correct. ↑ PERMITTIVITY

QC032 absolute permittivity (*n.*) The product of the permittivity of a vacuum and the relative permittivity; it is given the symbol ϵ.

$$\epsilon = \epsilon_r \epsilon_0$$

It is used in the general case of the force between two electric charges in any medium.

$$F = \frac{Q_1 Q_2}{4\pi\epsilon d^2}$$

QC033 electric space constant (*n.*) Alternative term for PERMITTIVITY (↑) of a vacuum (or of free space).

QC034 dielectric constant (*n.*) The ratio of the capacitance of a capacitor with a given substance as a dielectric to the capacitance of the capacitor with a vacuum (or air for approximate results) as the dielectric. Being a ratio it is a pure number; the symbol for it is ϵ_r. The dielectric constant is identical with RELATIVE PERMITTIVITY (↑); the latter term is now preferred. ↑ PERMITTIVITY

QC035 specific inductive capacity (*n.*) Old term for DIELECTRIC CONSTANT (↑).

QC036 capacitor (*n.*) A capacitor consists of two electrical conductors separated by an insulator; its simplest form is the parallel plate capacitor, consisting of two plane parallel metal plates separated by a layer of air or other dielectric. ↓ VARIABLE CAPACITOR · ELECTROLYTIC CAPACITOR · LEYDEN JAR · CAPACITANCE ↑ DIELECTRIC

QC037 variable capacitor (*n.*) This consists of two sets of interleaved parallel metal vanes; one set is fixed, and the other set can be rotated to vary the capacitance. ↑ CAPACITOR

QC038 electrolytic capacitor (*n.*) Two long strips of aluminium are interleaved with paper soaked in ammonium borate and the strips rolled into a cylinder. An electric current is passed through the capacitor, and an oxide layer is formed, which acts as a dielectric. An electrolytic capacitor must always be connected in circuit so that a polarizing current flows through in the correct direction. ↑ CAPACITOR

QC039 Leyden jar (*n.*) A type of capacitor of historical interest; originally it was a bottle covered with lead foil inside and outside. The foil provided the two conductors of a capacitor and the glass of the bottle was the dielectric. ↑ CAPACITOR

QC040 capacitance (*n.*) The property of a capacitor which allows it to store electric charge when a potential difference exists between the two conductors. The charge which is stored is proportional to the p.d between the conductors; this is a constant relationship.

$$\frac{Q}{V} = \text{constant.}$$

The constant is called the capacitance (symbol *C*) of the capacitor: $Q = CV$. Capacitance is measured in farads; this is a very large unit, so μF (microfarads) is the more common unit. The capacitance of a parallel plate capacitor of area *A*, the plates separated by a distance *d* in which is a dielectric of absolute permittivity, ϵ, is given by:

$$C = \frac{\epsilon A}{d}$$

↑ CAPACITOR

QC041 capacitative (*adj.*) Of or to do with capacitance, *e.g.* a capacitative circuit is one with devices offering capacitance in the circuit. ↑ DIELECTRIC

QC042 dipole[1] (*n.*) If the electrons in an atom, or a molecule, are displaced, a dipole is formed with point electric charges (negative and positive). The electron displacement can arise from, ***a*** electronegativity of atoms in molecules; ***b*** the effect of an electric field. In a molecule of hydrogen chloride, chlorine has a much greater electronegativity than hydrogen, so electrons in the bond joining the atoms are nearer to the chlorine atom than to the hydrogen atom. This creates a dipole, indicated thus:

$$\overset{\delta+}{\text{H}} \text{———} \overset{\delta-}{\text{Cl}}$$

where $\delta+$ indicates a small positive charge due to displacement, and $\delta-$ a similar small negative charge; the magnitudes of the two charges are equal. In an atom, an electric field can distort the orbitals of the electrons and the nucleus then has a small positive charge balanced by a small negative charge arising from the displaced electron or electrons. ↓ DIPOLE MOMENT · ELECTRIC DISPLACEMENT · POLARIZED ↑ ELECTROSTATICS

QC043 dipole moment (*n.*) The product of the magnitude of either charge of a dipole and the distance separating the two point charges. Dipole moments often provide evidence on the structure of molecules, *e.g.* ***a*** a linear molecule such as carbon dioxide has no resultant dipole moment; ***b*** a molecule of water, from its dipole moment, is triangular in shape with an angle of 105° between the two O—H bonds. ↓ DEBYE UNIT · ELECTRIC POLARIZATION · POLARIZABILITY ↑ DIPOLE[1]

QC044 Debye unit (*n.*) A unit of measurement for the dipole moment of a molecule; it is equal to $3{\cdot}3356 \times 10^{-30}$ coulomb-metre. ↑ DIPOLE MOMENT

QC045 electric polarization (*n.*) The dipole moment per unit volume. ↑ DIPOLE MOMENT

QC046 polarizability (*n.*) A measure of the ability of a dielectric to be polarized. It is the ratio of the electric displacement (*D*) to the intensity of the electric field. ↑ DIPOLE MOMENT

QC047 electric displacement (*n.*) Assume a uniform electric field in free space (or a vacuum) with an electric intensity, *E*; the electric flux through unit area perpendicular to the field is *E*. Introduce a

dielectric into the field. The bound charges of atoms are displaced, giving rise to an electric field in the dielectric which opposes the applied electric field. The electric flux is reduced and assumes a new value, *D*, when the electric field becomes steady. *D* is called the electric displacement. It is also called ***flux density***. ↓ ELECTRIC INDUCTION · DISPLACEMENT CURRENT · DIELECTROPHORESIS

QC048 electric induction (*n.*) Alternative term for ELECTRIC DISPLACEMENT (↑).

QC049 displacement current (*n.*) When a dielectric is placed in an electric field, the bound charges are displaced causing a small electric current, the displacement current, to flow until the field is steady and no further displacement takes place. ↑ ELECTRIC DISPLACEMENT

QC050 dielectrophoresis (*n.*) The motion of electrically polarized particles in a non-uniform electric field. ↑ ELECTRIC DISPLACEMENT

QC051 polarized (*adj.*) When a dielectric is placed in an electric field, the charges in the crystal lattice are slightly displaced; the dielectric is said to be polarized. ↑ DIPOLE[1]

Evolution

RA001 evolution[2] (*n.*) Gradual change in the characteristics of living things, taking place over many millions of years, occurring in the course of successive generations descended from related ancestors. The theory of evolution accounts for all types of organisms now existing, both plant and animal. There is much evidence, provided by the records of fossils, to support the theory of evolution. —EVOLVE (*v.*) ↓ DARWINISM · CONVERGENCE · FOSSIL · GEOLOGY · EXTINCT · ETHNIC

RA002 Darwinism (*n.*) The theory of evolution based on natural selection. ↓ NATURAL SELECTION · SEXUAL SELECTION · EPIGAMIC CHARACTER · ADAPTATION[3] ↑ EVOLUTION[2]

RA003 natural selection (*n.*) The principal mechanism of evolutionary change. The range of individuals in a population contains many variants; successful variants make a greater contribution of progeny and are said to be selected. Those selected have a greater survival value than the remaining variants. Of all the variations possible in an individual, only those which are heritable are important for evolution. Natural selection controls the composition of a population by eliminating some variants and preventing change in that direction and by allowing other variants to become more prevalent and thus encouraging change in that direction. ↑ DARWINISM

RA004 sexual selection (*n.*) Suggested by Darwin as a possible method of evolution; it presumes the females select the males for mating, choosing the male because it possesses certain characteristics, and thereby transmitting these characteristics to future generations. This theory attempts to explain the bright colours of males and their courtship behaviour, *i.e.* the secondary sexual characteristics of many animals. However the rejected males probably do find a mate, as the males of a species are never much more numerous than the females, and hence all the females do not have an opportunity for sexual selection in the fullest sense Secondary sexual characteristics probably cause successful sexual reproduction and their development could thus arise from natural selection. ↑ DARWINISM

RA005 epigamic character (*n.*) A characteristic of an animal that is associated with sexual reproduction but is not part of the gonads or associated structures, *e.g.* the tail of a peacock, the song of a bird and the stridulation of grasshoppers are all epigamic characteristics of these animals. ↑ DARWINISM → STRIDULATION

RA006 adaptation[3] (*n.*) (In evolution) any characteristic of an organism which improves its chances of survival and leaving descendants in the environment in which the organism lives. The organism's chances are improved in comparison with similar organisms which do not possess the characteristic. The adaptation can be to a particular feature of the environment, *e.g.* the colour of an antelope matches the colour of its surroundings; the leaf of a cactus limits water losses in a dry environment. The adaptation can be to a particular activity of an organism, *e.g.* the teeth of herbivores are adapted to the mastication of grass. ↑ DARWINISM

RA007 convergence (*n.*) The gradual production of some similar characteristics between unrelated groups of animals. Groups of organisms which originally differed considerably have evolved into organisms with similar features, *e.g.* whales and fish exhibit similar characteristics but whales have evolved from primitive mammals and fish have evolved from a primitive chordate. ↓ CONVERGENT EVOLUTION ↑ EVOLUTION[2]

RA008 convergent evolution (*n.*) Alternative term for CONVERGENCE (↑).

RA009 fossil (*n.*) The remains of an organism or visual evidence of its presence in rocks. The remains are usually those of animals with hard skeletons; the evidence is usually an impression or cast. Fossils are most commonly found in rock formations deposited by water; the skeleton is often

replaced by mineral deposits. The whole organism is often washed and eroded away leaving a hollow mould to indicate the structure of the dead organism. —***fossilize*** (*v.*) ***fossiliferous*** (*adj.*) ↓ EXTINCTION[1] · OBSOLESCENCE ↑ EVOLUTION[2]

RA010 extinction[1] (*n.*) (Of a species) the state of becoming or being extinct. —EXTINCT (*adj.*) ↓ EXTINCT ↑ FOSSIL

RA011 obsolescence (*n.*) The process of becoming obsolete; the gradual diminishing of a species of an organism until it becomes extinct; the gradual cessation of a physiological process *e.g.* ***a*** the obsolescence of the giant reptiles at the end of the Carboniferous Age; ***b*** the obsolescence of production of rennin as mammals grow towards adulthood. ↑ FOSSIL → OBSOLETE[2]

RA012 geology (*n.*) The study of the structure of the earth, its constituent substances, the forces and agents acting during the historical development of those structures, and the fossils found in the various structures. —***geologist*** (*n.*) ***geological*** (*adj.*) ↓ PALAEONTOLOGY · ANTHROPOLOGY · ETHNOLOGY ↑ EVOLUTION[2]

RA013 palaeontology (*n.*) The study of living organisms, past and present, on the earth. The knowledge of past forms of life is obtained from fossil records. The study includes the relationship of early forms of organisms with later forms. —***palaeontologist*** (*n.*) ***palaeontological*** (*adj.*) ↑ GEOLOGY

RA014 anthropology (*n.*) The study of man as an animal organism and as a member of a society. —***anthropologist*** (*n.*) ***anthropological*** (*adj.*) ↑ GEOLOGY

RA015 ethnology (*n.*) The study of man living in a society and of the distribution, relationships and activities of the cultures of those societies. —ETHNIC (*adj.*) ***ethnological*** (*adj.*) ↑ GEOLOGY

RA016 extinct (*adj.*) Describes species of organisms which no longer exist, *e.g.* the giant reptiles of the Mesozoic Era are extinct. ↑ EVOLUTION[2]

RA017 ethnic (*adj.*) Of, or to do with, ethnology or the races of **mankind**. ↑ EVOLUTION[2]

Reproduction

SA001 reproduction (*n.*) The process in an animal or a plant by which new individuals are brought into existence. It is the most important function of any organism as without it that species of organism will no longer exist. The two main mechanisms of reproduction are sexual reproduction, in which two individuals are involved in reproducing new individuals, and asexual reproduction, in which one individual organism reproduces new individuals. —REPRODUCTIVENESS, REPRODUCTIVITY (*n.*) ***reproductive*** (*adj.*) ***reproduce*** (*v.*) ↓ MOTHER · REPRODUCTIVENESS · MATE[2] · VIABLE · GAMOGENESIS · AGAMOGENESIS → SEXUAL REPRODUCTION · ASEXUAL REPRODUCTION · ALTERNATION OF GENERATIONS · GENITAL ORGANS · FLOWER · LIFE CYCLE · ZYGOTE[1] · HEREDITY

SA002 mother (*n.*) **1** A cell from which two cells are reproduced by binary fission; the reproduced cells are **daughter cells.** **2** A female animal which has produced offspring by sexual reproduction. ↓ DAUGHTER · PARENT · OFFSPRING · ANCESTORS · ANCESTRY · PARENTAGE · PROGENY · DESCENDANT · MATE[1] ↑ REPRODUCTION → GENERATION[2]

SA003 daughter (*n.*) **1** A cell or organism reproduced asexually from a mother cell or mother organism. **2** A female child; the term is used particularly to indicate relationship with a parent. ↑ MOTHER

SA004 parent (*n.*) **1** One of two living organisms from which another organism is reproduced. A parent takes part in sexual reproduction and is either male, female, or occasionally hermaphrodite. **2** An object from which others are obtained or devised. —***parental*** (*adj.*) ***parentage*** (*n.*) ↑ MOTHER (H) → FATHER (H) · HERMAPHRODITE

SA005 offspring (*n.,pl.* **offspring**) Animals reproduced sexually by parents; the parents and the offspring form a family of animals, the offspring belonging to the same generation. The term can also be used for the plants reproduced sexually by two specific plants at one particular time, particularly on the occasion of an experiment □ *the offspring of a donkey and a horse are sterile; each offspring of a colour-blind father and a normal vision mother will have normal vision* ↑ MOTHER

SA006 ancestors (*n.pl.*) **1** The related individuals of preceding generations starting from a particular individual, *i.e.* the parents, grandparents, great grandparents, and generations before that. **2** The members of an earlier species from which a species under consideration has evolved or descended. —ANCESTRY (*n.*) ***ancestral*** (*adj.*) ↓ PROGENY (Ag) ↑ MOTHER → EVOLVE[3]

SA007 ancestry (*n.*) A list or description of the ancestors of an individual, species, or group. Compare **parentage,** which implies a consideration of a few generations, or even one generation only, of the ancestors of an individual. —***ancestral*** (*adj.*) ↑ MOTHER

SA008 parentage (*n.*) See ANCESTRY above. ↑ MOTHER

SA009 progeny (*n.pl.*) The individuals of successive generations starting from a particular parent or parents. Compare

offspring which is restricted in use to animals and plants in one generation. ↑ MOTHER · ANCESTORS (Ag)

SA010 descendant (*n.*) An individual organism considered in relation to its ancestors, *e.g.* if A is an ancestor of B, then B is a descendant of A. ↑ MOTHER · ANCESTORS (Cn)

SA012 mate[1] (*n.*) An animal, male or female, living with an animal of the opposite sex for the purpose of producing offspring. —MATE (*v.*) ↑ MOTHER

SA013 reproductiveness (*n.*) The extent to which a species or an individual reproduces; a measure of the number of new individuals produced, *e.g.* the reproductiveness of plants by asexual mechanisms is greater than reproductiveness by sexual mechanisms. ↓ REPRODUCTIVITY · VIABILITY · BREEDING ↑ REPRODUCTION

SA014 reproductivity (*n.*) The disposition to reproduce, *e.g.* keeping male and female rabbits apart increases their reproductivity when they are brought together. ↑ REPRODUCTIVENESS

SA015 viability (*n.*) **1** The disposition to reproduce either sexually or asexually. **2** The disposition to live or develop. **3** The disposition to survive birth. —VIABLE (*adj.*) ↑ REPRODUCTIVENESS

SA016 breeding (*n.*) The process of getting plants or animals to reproduce offspring from selected parents by providing advantageous conditions. The intention of breeding is to produce new varieties of plants or types of animal, which will possess advantageous characteristics for use by man, *e.g.* ***a*** breeding rice plants to obtain a variety which can be cropped two or three times a year instead of once; ***b*** breeding mules from horses and donkeys to provide an animal more suitable than either a horse or a donkey for transportation. ↑ REPRODUCTIVENESS

SA017 mate[2] (*v.t.,i.*) **1** To take a mate or to become a mate with another animal. **2** To put two animals of opposite sex and the same species together with the intention of producing offspring. ↓ BREED (H) ↑ REPRODUCTION

SA018 breed (*v.t.*) To mate animals for a special purpose, usually to improve the characteristics of the animal for a definite purpose by keeping records and allowing only selected animals to mate. The term is used for improving plants by selection and controlled pollination. —***breed, breeder*** (*n.*) ***bred*** (*adj.*) ↑ MATE[2] → POLLINATION

SA019 viable (*adj.*) **1** Describes an organism, or a group of organisms, that have the disposition to reproduce. **2** Capable of living or developing. **3** Capable of surviving birth. —VIABILITY (*n.*) ↓ NONVIABLE (An) · REPRODUCTIVE ↑ REPRODUCTION

SA020 non-viable (*adj.*) Describes an organism or a colony of organisms that do not have the ability to reproduce. ↑ VIABLE (An)

SA021 reproductive (*adj.*) Describes a structure concerned with reproduction, *e.g.* ***a*** the reproductive organs of an animal; ***b*** the reproductive system of a mammal. ↑ VIABLE

SA022 gamogenesis (*n.*) The production of offspring through the union of gametes. —***gamogenetic*** (*adj.*) ↓ SYNGAMY · DICHOGAMY · PSEUDOGAMY · MONOGYNY · AUTOGAMOUS ↑ REPRODUCTION

SA023 syngamy (*n.*) **1** Reproduction by the fusing of gametes, *i.e.* sexual reproduction in all its forms. The focus is on the process of fusion. **2** Fusion of morphologically similar unicellular organisms. —SYNGAMETIC (*adj.*) ↓ ISOGAMY · ANISOGAMY · MICROGAMY · MEROGAMY · AMPHIMIXIS · OOGAMY · HOLOGAMY ↑ GAMOGENESIS

SA024 isogamy (*n.*) A form of sexual reproduction in which isogamates fuse; it occurs in some Protozoa, green algae and fungi. The process of union is called conjugation. The isogametes are described as, ***a*** male and female, if one gamete is transferred to another organism, as in green algae; ***b*** as *plus* and *minus* in the case of fungal hyphae; ***c*** or not described at all, as in the case of Protozoa. In fungi, the process can be heterothallic or homothallic. —***isogamous*** (*adj.*) ↓ ANISOGAMY (An) ↑ SYNGAMY → CONJUGATION TUBE · GAMETANGIUM · HETEROTHALIC · HOMOTHALLIC

SA025 anisogamy (*n.*) Sexual reproduction by the union between two unlike gametes in which, ***a*** the gametes may differ in size, but are similar in form, or, ***b*** may differ in size and form; ***a*** excludes oogamy, ***b*** includes oogamy. —***anisogamous*** (*adj.*) ↓ OOGAMY (H) ↑ SYNGAMY

SA026 microgamy (*n.*) Syngamy by the union of microgametes with macrogametes. ↓ MEROGAMY (H) ↑ SYNGAMY

SA027 merogamy (*n.*) **1** Syngamy by the union of merogametes with hologametes. **2** The condition of producing merogametes. ↑ SYNGAMY

SA028 amphimixis (*n.*) The mingling of the characteristics of the male and female parents through union of their gametes in sexual reproduction. ↑ SYNGAMY → APOMIXIS (I)

SA029 oogamy (*n.*) Sexual reproduction by the union between a large, non-motile egg-cell (a female gamete) and a small, motile, male gamete; it occurs especially in some plants and in all *Metazoa*. —***oogamous*** (*adj.*) ↑ SYNGAMY

SA030 hologamy (*n.*) The condition of having gametes of similar size to the somatic cells of the individual itself. ↑ SYNGAMY

SA031 dichogamy (*n.*) A condition in which the male and female sex organs of a flower ripen at different times, to ensure that self-pollination does not happen. —***dichogamous*** (*adj.*) ↓ HOMOGAMY (An) · ALLOGAMY · INBREEDING · ENDOGAMY · OUTBREEDING ↑ GAMOGENESIS → PROTANDRY (H) · PROTOGYNY (H)

SA032 homogamy (*n.*) A condition in

which the male and female sex organs of a flower ripen at the same time. Self-pollination can happen as well as cross-pollination ↑ DICHOGAMY (An)

SA033 allogamy (*n.*) The reproductive process of cross-fertilization in plants; breeding from unrelated parents. —ALLOGAMOUS (*adj.*) ↓ ENDOGAMY (An) · AUTOGAMY (An) ↑ DICHOGAMY

SA034 inbreeding (*n.*) The production of progeny by the mating of closely related parents. Less variation occurs in the characteristics of the offspring; deleterious characteristics are also more likely to appear in the progeny. —***inbred*** (*adj.*) ↓ OUTBREEDING (An) ↑ DICHOGAMY

SA035 endogamy (*n.*) **1** Alternative term for INBREEDING. **2** Self-fertilization. —***endogamous*** (*adj.*) ↑ DICHOGAMY · ALLOGAMY (An)

SA036 outbreeding (*n.*) Hybridization to obtain new traits or characteristics under conditions of controlled breeding. ↑ INBREEDING (An) · DICHOGAMY

SA037 pseudogamy (*n.*) (In some nematodes and a few higher plants) reproduction by development of an ovum arising from activation by a spermatozoon but without fusion of the nuclei; the spermatozoon plays no part thereafter in the reproductive process. ↓ AUTOGAMY · APOGAMY · APOSPORY ↑ GAMOGENESIS

SA038 autogamy (*n.*) **1** (In some Protozoa) a process in which the nucleus divides into two parts and the parts subsequently reunite, *e.g.* *Paramecium* undergoes autogamy. **2** The reproductive process in plants where self-fertilization occurs. —AUTOGAMOUS (*adj.*) ↑ ALLOGAMY (An) · PSEUDOGAMY

SA039 apogamy (*n.*) In Pteridophytes, apogamy occurs when a diploid gametophyte cell produces a sporophyte, as exhibited by some fern species. The prothallus fails to develop gametangia or one type may fail to develop; vegetative tissue produces the sporophyte. ↑ PSEUDOGAMY

SA040 apospory (*n.*) The process in some plants in which an ordinary sporophyte cell substitutes for a spore, meiosis does not occur, and a diploid gametophyte is produced, *e.g.* in some mosses. ↑ PSEUDOGAMY

SA041 monogyny (*n.*) **1** The condition of a male having only one female mate. **2** The condition of a flower having only one pistil. —MONOGYNOUS (*adj.*) ↓ POLYGYNY (An) · MONANDRY · POLYANDRY · MONOGAMY · POLYGAMY ↑ GAMOGENESIS

SA042 polygny (*n.*) **1** The condition of a male having more than one female mate. **2** The condition of a flower having many separate styles. —POLYGYNOUS (*adj.*) ↑ MONOGYNY (An)

SA043 monandry (*n.*) **1** The condition of a female having only one male mate. **2** The condition of a flower having only one stamen. —MONANDROUS (*adj.*) ↓ POLYANDRY (An) ↑ MONOGYNY

SA044 polyandry (*n.*) **1** The condition of a female having more than one mate. **2** The condition of a flower having 20 or more free stamens. —POLYANDROUS (*adj.*) ↑ MONOGYNY · MONANDRY (An)

SA045 monogamy (*n.*) The condition of having only one mate. —***monogamous*** (*adj.*) ↓ POLYGAMY (An) ↑ MONOGYNY

SA046 polygamy (*n.*) **1** The condition of having more than one mate. **2** The condition of having hermaphrodite male and female flowers on the same individual plant. —***polygamous*** (*adj.*) ↑ MONOGYNY · MONOGAMY (An)

SA047 autogamous (*adj.*) (In plants) self-fertilizing. ↓ ALLOGAMOUS (An) ↑ GAMOGENESIS

SA048 allogamous (*adj.*) Describes plants that reproduce sexually by cross-fertilization. ↑ AUTOGAMOUS

SA049 agamogenesis (*n.*) The production of offspring by other than sexual reproduction; the term includes asexual reproduction and parthenogenesis. —AGAMIC (*adj.*) ↓ APOMIXIS · AGAMIC ↑ REPRODUCTION

SA050 apomixis (*n.*) A reproductive process without fertilization which has the appearance of sexual reproduction as a sexual animal, or plant, produces the offspring; it includes parthenogenesis, apospory and apogamy. The term is also used to describe vegetative reproduction when the normal sexual organs of a plant are either not functioning properly or not functioning at all. The focus is on the inheritance of characteristics from one parent only. ↓ AGAMOSPERMY ↑ AGAMOGENESIS → AMPHIMIXIS (I)

SA051 agamospermy (*n.*) All types of apomixis, excluding vegetative propagation. ↑ APOMIXIS

SA052 agamic (*adj.*) Describes reproduction without gametes, *i.e.* asexual reproduction or parthenogenesis. ↓ AGAMOUS ↑ AGAMOGENESIS

SA053 agamous (*n.*) **1** Describes reproduction in plants which do not possess true flowers or seeds. **2** Alternative term for AGAMIC (↑).

Sexual Reproduction

SB001 sexual reproduction (*n.*) Reproduction involving the fusion of two gametes, one from each of two different individuals. The advantage of sexual reproduction is the inheritance of characteristics from each parent, increasing the variety of individuals; the disadvantage, particularly in plants, is the relative slowness of increase of the species as compared to asexual reproduction. ↓ GAMETE · ISOGAMETE · MICROGAMETE · GAMETOGENESIS · FERTILIZATION · CONCEIVE · MONOECIOUS · SYNGAMETIC · GONAD · OVARY[1] · OESTROUS CYCLE · TESTIS · CONJUGATION · ARCHEGONIUM → REPRODUCTION

SB002 gamete (*n.*) A specialized reproductive cell; its nucleus is haploid in true sexual reproduction, *i.e.* it contains only half the number of chromosomes in the somatic cells of the species of organism; its function is to fuse with another haploid gamete. Gametes in true sexual reproduction are differentiated into male and female but in other forms of sexual reproduction it may be similar in size and/or in structure. Diploid gametes also occur; they take part in parthenogenesis □ *gametes are released from an organism* —***gametal*** (*adj.*) ↓ GERM CELLS · PRONUCLEUS · GAMETOCYTE · GAMETID ↑ SEXUAL REPRODUCTION → HAPLOID · DIPLOID · PARTHENOGENESIS · OVUM (H) · SPERM (H) · SPERMATOZOON (H)

SB003 germ cells (*n.*) (In *Metazoa*) a specialized reproductive cell as opposed to a somatic cell; the function of the cell is reproduction by fusion with another germ-cell. Mature male and female germ-cells develop by meiosis from cells of normal size and structure situated in the gonads; in the process, the diploid nucleus becomes haploid (except in parthenogenesis), and extensive changes take place in the cytoplasm of the cells. ↑ GAMETE (Sn) → MEIOSIS · OOCYTE · SPERMATOCYTE · OVUM (H) · SPERMATOZOON (H)

SB004 pronucleus (*n.*) The nucleus of a mature male or female gamete, especially the male pronucleus after its entry into an ovum at fertilization but before fusion with the female pronucleus, or the female pronucleus of an ovum after completion of meiosis but before fusion with a male pronucleus. A pronucleus is haploid. ↑ GAMETE

SB005 gametocyte (*n.*) A mother-cell which undergoes meiosis to produce a gamete. ↑ GAMETE · GERM CELLS → OOCYTE (H) · SPERMATOCYTE (H)

SB006 gametid (*n.*) A primary sporoblast released from a sporont; it develops into a gamete. ↑ GAMETE → SPOROBLAST · SPORONT

SB007 isogamete (*n.*) One of two undifferentiated gametes, similar in size and form, *e.g.* gametes of some green algae and fungi. —***isogametism*** (*n.*) ***isogametous*** (*adj.*) ↓ ANISOGAMETE · HETEROGAMETE · SEX · GONIDIUM · SEXUALITY ↑ SEXUAL REPRODUCTION

SB008 anisogamete (*n.*) One of two dissimilar gametes, differing in size, form, or both, *e.g.* spermatozoa and ova are anisogametes. —ANISOGAMETISM (*n.*) ***anisogametous*** (*adj.*) ↑ ISOGAMETE

SB009 heterogamete (*n.*) Alternative term for ANISOGAMETE. ↑ ISOGAMETE

SB010 sex (*n.*) The characteristics, structures and functions by which an animal or a plant is classed as male or female. —SEXUALITY (*n.*) ***sexual*** (*adj.*) ↑ ISOGAMETE

SB011 gonidium (*n.,pl.* **gonidia**) **1** A minute reproductive body in many bacteria. **2** An asexual spore produced by a gametophyte. ↑ ISOGAMETE → GAMETOPHYTE

SB012 sexuality (*n.*) The characteristic of being sexual, *e.g.* the sexuality that humans develop at puberty. ↑ ISOGAMETE

SB013 microgamete (*n.*) The smaller of two conjugating anisogametes, regarded as the male gamete and differentiated from the female gamete mainly by size. —MICROGAMETOGENESIS (*n.*) ↓ MACROGAMETE (P) · MEGAGAMETE · MEROGAMETE (H) · HOLOGAMETE · MICROGAMETOCYTE · MACROGAMETOCYTE · MEGAGAMETOCYTE · COENOGAMETE ↑ SEXUAL REPRODUCTION · ANISOGAMETE → MICROCONJUGANT (H) · MICROGAMY

SB014 macrogamete (*n.*) The larger of two conjugating anisogametes; it is a rounded cell regarded as a female gamete or ovum and it is differentiated from a male gamete mainly by size. ↓ MACROGAMETOCYTE ↑ MICROGAMETE (P)

SB015 megagamete (*n.*) Alternative term for MACROGAMETE. —***megagametogenesis*** (*n.*) ↑ MICROGAMETE (P)

SB016 merogamete (*n.*) (In some Protozoa) a male gamete formed by multiple division; the gametes are much smaller than the organism itself. When the male gamete is strongly differentiated by size from the female gamete, as in *Plasmodium*, the male gamete is called a merogamete instead of a microgamete. ↓ HOLOGAMETE (P) ↑ MICROGAMETE

SB017 hologamete (*n.*) (In some *Protozoa*) a female gamete which is the same size as the organism itself; only one is produced from the gametocyte. The term is used when the male and female gametes are strongly differentiated by size. ↑ MICROGAMETE · MEROGAMETE (P)

SB018 microgametocyte (*n.*) (In some Protozoa, such as *Plasmodium* the causative agent of malaria) a cell developed from a merozoite; it produces microgametes by division. ↓ MACROGAMETOCYTE (P) · MEGAGAMETOCYTE (P) ↑ MICROGAMETE

SB019 macrogametocyte (*n.*) (In some Protozoa) the mother-cell of a macrogamete developed from a merozoite. ↑ MICRO-

GAMETE · MACROGAMETE · MICROGAMETOCYTE (P)

SB020 megagametocyte (*n.*) An alternative term for MACROGAMETOCYTE. ↑ MICROGAMETE

SB021 coenogamete (*n.*) A multinucleate gamete. ↑ MICROGAMETE

SB022 gametogenesis (*n.*) The formation of gametes in reproductive organs. ↓ ANISOGAMETISM · SYNGENESIS · MICROGAMETOGENESIS · MEGAGAMETOGENESIS ↑ SEXUAL REPRODUCTION → OOGENESIS (H) · SPERMATOGENESIS (H)

SB023 anisogametism (*n.*) The production by an organism of anisogametes, *e.g.* the production in flowering plants of macrogametes and microgametes. ↑ ANISOGAMETE · GAMETOGENESIS

SB024 syngenesis (*n.*) The reproduction of offspring by the fusion of gametes. The focus is on the production of offspring and the acquisition by the offspring of characteristics from each parent, passed on by means of the gametes. —***syngenetic*** (*adj.*) ↑ GAMETOGENESIS → SYNGAMY

SB025 microgametogenesis (*n.*) The development and production of microgametes or spermatozoa. ↑ GAMETOGENESIS · MICROGAMETE → SPERMATOZOON

SB026 megagametogenesis (*n.*) The development and production of macrogametes (or megagametes) or ova. ↑ MACROGAMETE · GAMETOGENESIS → OOGENESIS (H)

SB027 fertilization (*n.*) In animals and the lower plants fertilization is the union of two gametes by the fusion of their pronuclei to form a single cell, a zygote. Fertilization consists of the fusion of two haploid pronuclei to form a diploid nucleus and initiation of the development of a new individual from the zygote. It is the essential process of sexual reproduction. In pseudogamy and parthenogenesis the female gamete usually has a diploid nucleus; there is no fusion of two pronuclei and only development of the individual occurs. Compare **fertilization,** which is the fusion of heterogametes resulting in a zygote or oospore, with **conjugation,** which is the fusion of isogametes resulting in a zygospore. In flowering plants, double fertilization takes place. ↓ EXTERNAL FERTILIZATION · INTERNAL FERTILIZATION · FERTILIZATION MEMBRANE · CROSS-FERTILIZATION · SELF-FERTILIZATION · CONCEPTION ↑ SEXUAL REPRODUCTION → CONJUGATION · DOUBLE FERTILIZATION

SB028 external fertilization (*n.*) In many aquatic animals and Amphibia the union of gametes takes place outside the body of the female; spermatozoa and ova are shed into the water and fertilization takes place when they meet, *e.g.* as in bony fish and Echinodermata. ↑ FERTILIZATION

SB029 internal fertilization (*n.*) In most terrestrial animals, such as arthropods, tetrapods, etc., the union of gametes takes place inside the body of the female; it also occurs in some aquatic animals, such as cartilaginous fishes. ↑ FERTILIZATION

SB030 fertilization membrane (*n.*) A tough membrane that appears and covers the surface of many ova after fertilization. In many animals it is the vitelline membrane. ↑ FERTILIZATION → OVUM · VITELLINE MEMBRANE

SB031 cross-fertilization (*n.*) The union of male and female gametes produced by different individuals of the same species. ↓ SELF-FERTILIZATION (An) ↑ FERTILIZATION

SB032 self-fertilization (*n.*) The union of male and female gametes produced by the same individual. ↑ FERTILIZATION · CROSS-FERTILIZATION (An) → SELF-STERILITY (An)

SB033 conception (*n.*) The accomplished act of conceiving. ↑ FERTILIZATION

SB034 conceive (*v.i.*) (Of female mammals) to have an ovum fertilized and to produce an embryo in the uterus; to become pregnant. —***conceptive*** (*adj.*) ↑ SEXUAL REPRODUCTION

SB035 monoecious (*adj.*) **1** (In plants) possessing both male and female reproductive organs on the same individual; (in flowering plants) possessing separate male and separate female flowers on the same individual. **2** (In animals) having both male and female gonads in the same individual, *i.e.* hermaphrodite. ↓ DIOECIOUS · BISEXUAL · UNISEXUAL ↑ SEXUAL REPRODUCTION → HOMOTHALLIC · HETEROTHALLIC · HERMAPHRODITE (Sn)

SB036 dioecious (*adj.*) **1** (In plants) possessing either male or female reproductive organs on a single individual; (in flowering plants) having unisexual flowers; all the flowers on a single plant are either male or female. **2** (Of animals) possessing either male or female gonads, *e.g.* human beings are dioecious. ↓ UNISEXUAL (Sn) ↑ MONOECIOUS

SB037 bisexual (*adj.*) Describes a hermaphrodite; possessing both male and female gonads or male and female structures on a flower. ↑ MONOECIOUS → HERMAPHRODITE

SB038 unisexual (*adj.*) **1** (In flowering plants) having separate male flowers (with stamens) and female flowers (with carpels). The plants can be either monoecious or dioecious. **2** (In animals) producing either male or female gametes but not both; the term corresponds to **dioecious**. ↑ MONOECIOUS → HERMAPHRODITE (An)

SB039 syngametic (*adj.*) Describes the union of morphologically similar unicellular organisms. ↑ SEXUAL REPRODUCTION

SB040 gonad (*n.*) (In animals) a sexual organ producing gametes; in some animals it produces hormones as well; the term includes ovary, testis, and ovotestis. In coelenterates, such as *Hydra,* the gonads may be temporary structures. —***gonadial*** (*adj.*) ↓ COITION · HERMAPHRODITE · OVOTESTIS (H) · PARTHENOGENESIS · FERTILITY[1] · STERILIZE · PROTANDROUS · ZYGOGENETIC · FERTILE[1] ↑ SEXUAL REPRODUCTION → OVARY (H) · TESTIS (H)

SB041 coition (*n.*) (In animals) a sexual act

between two individuals of opposite sex during which spermatozoa are made available to fertilize ova. ↓ COITUS · COPULATION (Sn) · AMPLEXUS ↑ GONAD

SB042 coitus (*n.*) Alternative term for COITION (↑).

SB043 copulation (*n.*) (In animals) a sexual union between two individuals of opposite sex during which spermatozoa are passed from a male organ to a female organ for the fertilization of ova. Hermaphrodite animals copulate by the union of the male organ of one animal with the female organ of the other, *e.g.* as in the earthworm. The term is almost identical in meaning with **coition**, but the implication is of a close bond between the two individuals, as in internal fertilization. —***copulatory*** (*adj.*) ***copulate*** (*v.*) ↑ COITION (Sn) · COITUS (Sn)

SB044 amplexus (*n.*) The sexual embrace of frogs and toads. The male assists in squeezing ova out of the female and fertilizes them before the jelly-like covering hardens round the ova. ↑ COITION

SB045 hermaphrodite (*n.*) **1** A flowering plant possessing both male and female structures on the same flower (stamens and carpels). **2** An animal possessing both male and female gonads, *e.g.* as in earthworms. **3** A unisexual animal having male and female gonads as an aberration. ↓ AGAMETE ↑ GONAD → MONOECIOUS (Sn)

SB046 agamete (*n.*) A germ-cell which develops into an adult without syngamy, as in parthenogenesis and pseudogamy. It is usually considered to be female, and usually possesses a diploid nucleus. ↑ HERMAPHRODITE → SYNGAMY

SB047 chimaera[2] (*r*) An organism in which there are tissues of two different genetic types. A chimaera can occur as a result of mutation or of an abnormal distribution of chromosomes arising during cell division (particularly during embryonic development); the cell's descendants produce a different genetic type. ↓ MOSAIC[2] (Sn) · GYNANDROMORPH (H) ↑ HERMAPHRODITE

SB048 mosaic[2] (*n.*) The more common term for an animal chimaera. ↓ GYNANDROMORPH (H) ↑ HERMAPHRODITE · CHIMAERA[2] (Sn)

SB049 gynandromorph (*n.*) An individual exhibiting male and female characteristics, *i.e.* a type of mosaic or chimaera; an abnormal individual with both male tissues and female tissues, genetically and structurally. The phenomenon occurs through abnormal distribution of chromosomes when an X-chromosome is lost, probably during cleavage. The occurrence is common in insects and occasional in birds and mammals. ↑ HERMAPHRODITE

SB050 intersex (*n.*) An organism with characteristics intermediate between male and female with all its cells genetically identical. It may first develop as male or female and then change sex in further development, *i.e.* it is a mosaic in time and not in spatial distribution. The occurrence of intersex may be caused by abnormal hormonal conditions, by abnormal effects in the sex chromosomes, or by other influences in development. ↑ HERMAPHRODITE

SB051 ovotestis (*n.*) (In some hermaphrodite animals) a reproductive gland which functions both as an ovary and a testis, *e.g.* in some gastropods, such as the snail. ↑ HERMAPHRODITE

SB052 rig (*n.*) A mammal, usually a horse or similar animal, whose testicles have not fully descended into the scrotum, or an imperfectly castrated animal. The animal is sexually impotent although not fully neuter. ↑ HERMAPHRODITE

SB053 parthenogenesis (*n.*) The development of an unfertilized ovum; the ovum is usually diploid and the offspring that are produced inherit all characteristics from the one parent. The condition occurs normally in some animals, such as aphids and rotifers, and in some plants. Frequently the production of individuals by parthenogenes alternates with the production of individuals by normal sexual means. The change to sexual reproduction is often brought about by the onset of adverse environmental conditions. —PARTHENOGENETIC (*adj.*) ↓ ARTIFICIAL PARTHENOGENESIS · AMPHITOKY ↑ GONAD → HETEROGAMY · APOMIXIS

SB054 artificial parthenogenesis (*n.*) The process of causing the development of an unfertilized egg by artificial means. It can be done by pricking the egg with a needle or treating it with acid. Some eggs activated in this fashion have been reared to an adult. The process can be carried out on animals not normally parthenogenetic, such as rabbits. ↑ PARTHENOGENESIS

SB055 amphitoky (*n.*) Parthenogenesis in which both male and female offspring are produced. ↑ PARTHENOGENESIS

SB056 fertility[1] (*n.*) The disposition to be fertile. ↓ STERILITY (I) · SELF-STERILITY · FERTILE[1] ↑ GONAD

SB057 sterility (*n.*) **1** The condition of being unable to reproduce sexually or asexually. **2** The complete absence of viable microorganisms. —***sterilization*** (*n.*) STERILE (*adj.*) STERILIZE (*v.*) ↑ FERTILITY[1] (I)

SB058 self-sterility (*n.*) The inability of an individual producing both male and female gametes to reproduce viable offspring by self-fertilization; it occurs in some hermaphrodites. The individual can only be fertile for cross-fertilization. ↑ FERTILITY[1]

SB059 sterilize (*v.t.*) To make an organism incapable of reproduction. —***sterilization*** (*n.*) STERILE (*adj.*) ↓ SPAY (H) · CASTRATE (H) ↑ GONAD

SB060 spay (*v.t.*) To remove ovaries from an animal. ↓ CASTRATE (Sn) ↑ STERILIZE

SB061 castrate (*v.t.*) To remove testes from an animal; to remove the androecium from a flower. ↑ STERILIZE · SPAY (Sn) → ANDROECIUM

SB062 protandrous (*adj.*) **1** (Of hermaphrodite animals) producing spermatozoa first then ova afterwards to prevent self-fertilization. **2** (Of a flower)

having the anthers ripening before the carpels; this prevents self-fertilization. —PROTANDRY (*n.*) ↓ PROTOGYNOUS (An) ↑ GONAD · HERMAPHRODITE

SB063 protogynous (*adj.*) **1** (Of hermaphrodite animals) producing ova first, then spermatozoa afterwards, to prevent self-fertilization. **2** (Of a flower) having the carpels ripening before the anthers; this prevents self-pollination. —***protogyny*** (*n.*) ↑ PROTANDROUS (An)

SB064 zygogenetic (*adj.*) Describes organisms developed from fertilized seeds or ova. ↓ PARTHENOGENETIC (An) · NEUTER ↑ GONAD

SB065 parthenogenetic (*adj.*) Describes organisms developed from seeds or ova without fertilization by male gametes. ↑ ZYGOGENETIC (An)

SB066 neuter (*adj.*) Of neither sex; sexless; without male or female reproductive organs. ↑ ZYGOGENETIC

SB067 fertile[1] (*adj.*) **1** (Of eggs, seeds and female germ-cells) capable of development after fertilization. **2** (Of female organisms) capable of producing living offspring by sexual reproduction. Contrast **viable** which means capable of any form of reproduction or capable of propagation. —FERTILITY (*n.*) ↓ VIRILE (Sn) · POTENT · STERILE (An) · SELF-FERTILE · SELF-STERILE · INFERTILE[1] (An) · BARREN[1] (An) · IMPOTENT ↑ GONAD

SB068 virile (*adj.*) Of or to do with the characteristics of a mature male, especially being capable of reproducing offspring. —***virility*** (*n.*) ↑ FERTILE[1] (Sn)

SB069 potent (*adj.*) (Of a male animal) capable of sexual relations with a female animal. ↓ IMPOTENT (An) ↑ FERTILE[1]

SB070 sterile (*adj.*) Unable to reproduce sexually or asexually. —STERILITY (*n.*) ↑ STERILITY · FERTILE[1] (An)

SB071 self-fertile (*adj.*) Describes an individual organism producing male and female gametes which can unite to reproduce viable offspring. —SELF-FERTILIZATION (*n.*) ↓ SELF-STERILE (An) ↑ FERTILE[1]

SB072 self-sterile (*adj.*) Describes an individual unable to reproduce viable offspring by self-fertilization. —SELF-STERILITY (*adj.*) ↑ FERTILE[1]

SB073 infertile[1] (*adj.*) Describes an individual who is not fertile under a set of existing conditions. Contrast **sterile**, which describes an individual who is never fertile. —***infertility*** (*n.*) ↑ FERTILE[1] (An) · STERILE (Sn)

SB074 barren[1] (*adj.*) Describes an infertile female. ↑ FERTILE[1] (An)

SB075 impotent (*adj.*) (Of a male animal) incapable of copulation with a female. ↑ FERTILE[1] · POTENT (An)

SB076 ovary[1] (*n.*) **1** (In female animals) the gonad; it produces ova. In vertebrates it also produces sex hormones. **2** (In plants) a hollow region at the base of a carpel; it contains one or more ovules —***ovarian*** (*adj.*) ↓ OVUM · OOGENESIS · VIVIPAROUS[1] · HETEROGYNOUS · OVOID · TESTIS (An) ⁺ SEXUAL REPRODUCTION → OVULE

SB077 ovum (*n.,pl.* **ova**) **1** (In animals) a mature, unfertilized female germ-cell. It is a large immobile cell containing a haploid nucleus, much cytoplasm, and yolk. **2** (In seed plants, such as *Spermatophyta*) a female nucleus in the embryo sac of an ovule □ *ova are shed into water; ova are discharged from an ovary* —OVOID (*adj.*) ↓ EGG CELL · YOLK[2] · OOCYTE · POLAR BODY · OOGONIUM · FOLLICLE CELL · OVARIAN FOLLICLE ↑ OVARY[1] → EGG (Sn) · SPERMATOZOON (Cm)

SB078 egg cell (*n.*) (In an egg) the ovum proper without any layer of cells or material for development or protection. ↑ OVUM (Sn)

SB079 yolk[2] (*n.*) The nutrient material in the form of protein and fat granules contained in the cytoplasm of the ova of most animals. It is the yellow part of a hen's egg. ↑ OVUM

SB080 oocyte (*n.*) A cell which undergoes meiosis to form an ovum. A primary oocyte divides to form a secondary oocyte and a polar body. The secondary oocyte contains a massive cytoplasm and the polar body hardly any; the secondary oocyte divides to form an ovum and another polar body; the polar bodies degenerate. Fertilization may take place in either of the oocyte stages before the formation of an ovum. ↓ SPERMATOCYTE (An) ↑ OVUM

SB081 polar body (*n.*) The primary polar body may divide to form two secondary polar bodies, making a total of 3 polar bodies produced from a primary oocyte. See OOCYTE (↑). ↑ OVUM

SB082 oogonium (*n.*) **1** (In animals) a cell in the ovary which divides by continual mitosis and produces oocytes. **2** (In certain thallophytes, such as algae and fungi), a female reproductive organ; it contains one or more oospheres. —***oogonial*** (*adj.*) ↑ OVUM → OOSPHERE · ANTHERIDIUM (An)

SB083 follicle cell (*n.*) One of the cells in an ovary which nourishes an oocyte. ↑ OVUM

SB084 ovarian follicle (*n.*) (In many *Metazoa*) a sac of cells surrounding a developing oocyte; it provides nourishment for the oocyte; it is located in the ovary of the animal. In vertebrates it secretes female sex hormones. ↓ OESTROUS CYCLE · GRAAFIAN FOLLICLE (H) ↑ OVUM

SB085 oogenesis (*n.*) The formation of ova. ↓ OVOGENESIS (Sn) · OVULATION ↑ OVARY[1] → SPERMATOGENESIS (An)

SB086 ovogenesis (*n.*) Alternative term for OOGENESIS (↑).

SB087 ovulation (*n.*) The discharge of oocytes from an ovary by the bursting of a ripe ovarian follicle or Graafian follicle. Ovulation is frequently caused by stimulation from hormones of the pituitary gland. —***ovulate*** (*v.*) ↑ OVARIAN FOLLICLE · OOGENESIS

SB088 viviparous[1] (*adj.*) **1** (In animals) giving birth to active offspring. The offspring develops inside the maternal animal and is nourished by close contact with the maternal tissues (through the

placenta in mammals) and without any egg membranes between the embryo and the mother. All placental animals are viviparous and some other groups of animals as well. **2** (In plants) having seeds which develop within the fruit, germinating while still attached to the parent plant; multiplying by means of shoots, as in some grasses, or by means of bulbils. —***viviparity*** (*n.*) ↓ OVIPAROUS (I) · OVOVIVIPAROUS (I) ↑ OVARY[1]

SB089 oviparous (*adj.*) (In animals) laying fertilized eggs in which the embryo must complete its full development outside the maternal body, *e.g.* as in birds. —***oviparity*** (*n.*) ↑ VIVIPAROUS[1] (I)

SB090 ovoviviparous (*adj.*) (In animals) producing eggs with persistent membranes; the embryo develops while the egg is in the maternal animal until near or at full maturation. The embryo is separated from the maternal tissues by the egg membranes but obtains nourishment from the maternal tissues. The eggs may hatch before they are laid, *e.g.* as in snails, many insects, some fish and some reptiles. —***ovoviviparity*** (*n.*) ↑ VIVIPAROUS[1] (I) · OVIPAROUS (I)

SB091 heterogynous (*adj.*) Having two types of females, *e.g.* as in bees where queens and some workers are both female. ↑ OVARY[1]

SB092 ovoid (*adj.*) Shaped like an egg. ↑ OVARY[1]

SB093 oestrous cycle (*n.*) (In most species of mammals) a reproductive cycle in four phases of short duration occurring in sexually mature females. The duration varies betwen 5 and 60 days, depending on the species. The four phases are, ***a*** growth of the Graafian follicle, proliferation of the endometrium, and increasing secretion of oestrogen; ***b*** ovulation and the period of oestrus; ***c*** formation of the corpus luteum in the ovary, decreasing secretion of oestrogen, development of uterine glands, and the secretion of progesterone by the corpora lutea (the luteal phase); ***d*** degeneration of the corpus luteum, beginning of growth of new Graafian follicle, return to normal of endometrium, decreasing secretion of oestrogen and the cessation of secretion of progesterone. If fertilization takes place, phase ***d*** does not occur and the cycle is discontinued during pregnancy. If no fertilization takes place the cycle is repeated; in some species there is one cycle in a breeding season; in all other species the cycle is immediately repeated. The cycle is controlled by hormones secreted by the pituitary gland; these hormones control activity of the ovaries; all other changes are controlled by oestrogen and progesterone. ↓ OESTRUS · MENSTRUAL CYCLE · LUTEAL ↑ SEXUAL REPRODUCTION

SB094 oestrus (*n.*) The second phase of the oestrous cycle, during which the mating reflexes are activated. It lasts for a day or two, and during this time, and at no other, the female will copulate with a male. Oestrus is also known as **heat** □ ***in oestrus***, or ***on heat*** —***oestrous*** (*adj.*) ↓ GRAAFIAN FOLLICLE ↑ OESTROUS CYCLE

SB095 Graafian follicle (*n.*) The ovarian follicle of mammals; it is a liquid-filled vesicular capsule containing an oocyte attached to the wall. Follicle cells surround the oocyte closely, but as development continues a cavity appears; the cavity enlarges during the first period of the oestrous cycle and continues until the follicle bursts on the surface of the ovary, discharging the oocyte. Many follicles never mature, but degenerate. The growth of follicles is under the control of hormones from the pituitary gland. Graafian follicles differ from ovarian follicles in possessing a cavity. ↑ OESTRUS

SB096 corpus luteum (*n.*) A temporary body producing the hormone progesterone; it is formed inside a Graafian follicle after the ovum has been released from the ruptured follicle. Under the stimulation of luteinizing hormone the follicle wall forms yellow secretory luteal tissue; the hormone prolactin promotes secretion of progesterone. If the egg is not fertilized the corpus luteum persists for about two weeks and then degenerates; if fertilization occurs the corpus luteum persists for about six months and continues to secrete progesterone. ↑ OESTRUS → PROGESTERONE

SB097 luteal phase (*n.*) The third phase in the oestrus cycle; during this phase the corpus luteum is formed, secretion of progesterone is initiated, secretion of oestradiol diminishes, and development of the endometrium takes place. In some mammals, such as the mouse, this phase is absent. ↑ OESTRUS

SB098 menstrual cycle (*n.*) (In catarrhine primates) a modified oestrous cycle characterized by, ***a*** sudden destruction of the developed mucous lining of the uterus at the end of the luteal phase, which produces bleeding; ***b*** the absence of a defined period of oestrus. ↓ MENSTRUATION · MENSES ↑ OESTROUS CYCLE

SB099 menstruation (*n.*) The periodic discharge of blood from the uterus of catarrhine mammals at the end of the luteal phase of the menstrual cycle. ↑ MENSTRUAL CYCLE

SB100 menses (*n.pl.*) The liquid, mainly consisting of blood, discharged during menstruation. ↑ MENSTRUAL CYCLE

SB101 luteal (*adj.*) Of or to do with the cells of the corpus luteum. ↓ BROODY ↑ OESTROUS CYCLE

SB102 broody (*adj.*) (Of birds) sitting on eggs to hatch them; the similar behaviour of any oviparous animal. ↑ LUTEAL

SB103 testis (*n., pl.* **testes**) (In animals) the sexual organ which produces male gametes or spermatozoa. In vertebrates it also produces hormones. ↓ SPERMATOZOON · SPERMATOGENESIS · TESTICLE · TESTICULAR ↑ SEXUAL REPRODUCTION · OVARY[1] (An)

SB104 spermatozoon (*n.,pl.* **spermatozoa**) (In animals) a small, motile male gamete;

except in Nematoda, decapods, some Myriapoda and mites, the gamete has a flagellum. It is almost all nucleus, with a very small cytoplasm. ↓ SPERM · SPERMATOCYTE · SPERMATID · SPERMATOGONIUM · ACROBLAST · ACROSOME · SPERMATOPHORE ↑ TESTIS → OVUM (An)

SB105 sperm (*n.*) An alternative term for SPERMATOZOON (↑).

SB106 spermatocyte (*n.*) **1 (In animals) a primary spermatocyte is formed from a spermatogonium by repeated mitosis. During meiosis, a primary spermatocyte divides to form two secondary spermatocytes. Each secondary spermatocyte then divides to form two spermatids. Four spermatids are formed from one primary spermatocyte. 2** (In plants) a cell which is converted to a spermatozoid. ↑ SPERMATOZOON → OOCYTE (An) · MITOSIS · MEIOSIS

SB107 spermatid (*n.*) A cell of normal shape when formed from a secondary spermatocyte; it undergoes extensive change and is converted into a spermatozoon. ↑ SPERMATOZOON

SB108 spermatogonium (*n.,pl.* **spermatogonia**) (In animals) a cell in the testes which develops by repeated division (mitosis) into a spermatocyte. ↑ SPERMATOZOON

SB109 acroblast (*n.*) A structure on a spermatid; it develops into an acrosome. ↑ SPERMATOZOON

SB110 acrosome (*n.*) A structure at the anterior end of a spermatozoon; it forms a cap over the nucleus. Its function is to assist the penetration of an egg during fertilization. ↑ SPERMATOZOON

SB111 spermatophore (*n.*) (In some species of invertebrate animals which have internal fertilization) a packet of spermatozoa enclosed in a membranous sac. The spermatozoa are introduced into the female other than by a penis, *e.g.* ***a*** a male spider deposits a spermatophore and carries it to the female in a specially adapted pedipalp; ***b*** a male grasshopper ejaculates spermatophores into the vagina of a female; the sac is digested in the vagina, and the spermatozoa are stored in a spermatheca. ↑ SPERMATOZOON

SB112 spermatogenesis (*n.*) The whole process of the formation of spermatozoa, from the development of spermatogonia, through spermatocytes and spermatids to spermatozoa. ↑ OOGENESIS (An) · TESTIS

SB113 testicle (*n.*) (Especially in mammals) alternative term for TESTIS (↑). —TESTICULAR (*adj.*)

SB114 testicular (*adj.*) Of or to do with the testes. ↑ TESTIS

SB115 conjugation (*n.*) **1** The whole process leading to the union of two isogametes, motile or non-motile, from unicellular or acellular organisms; a common type of syngamy found in Protozoa, green algae, and fungi. **2** The union between two bacteria during which part of the of the chromatin body of one bacterium is transferred to the other bacterium. **3** (In Ciliata) a process of sexual reproduction. Two individuals firstly become attached, their macronuclei disintegrate, and their micronuclei undergo meiosis to form finally two gamete nuclei. One gamete nucleus from each organism enters the other organism and fuses with the gamete nuclei there. A zygote nucleus is formed in each organism. The two organisms separate and the zygote nucleus gives rise eventually to a macronucleus and a micronucleus in each of four new individuals produced by binary fission from one of the conjugants. Two individuals undergoing conjugation give rise to 8 offspring. —CONJUGANT (*n.*) ↓ CONJUGANT · GAMETANGIUM · MICROCONJUGANT · HOMOTHALLISM · MACRONUCLEUS · HOMOTHALLIC ↑ SEXUAL REPRODUCTION → FERTILIZATION · SYNGAMY

SB116 conjugant (*n.*) An individual organism participating in conjugation. ↓ CONJUGATION TUBE · CONJUGATION CANAL · COPULANT · EXCONJUGANT ↑ CONJUGATION

SB117 conjugation tube (*n.*) A tube formed from the fusing of outgrowths from two conjugants; a male isogamete passes down the tube to fuse with the female isogamete; in bacteria, part of a chromatin body passes down the tube; in Ciliata, gamete nuclei pass down the tube. ↑ CONJUGANT

SB118 conjugation canal (*n.*) Alternative term for CONJUGATION TUBE (↑).

SB119 copulant (*n.*) One of two units in conjugation with one another, such as cells, hyphae, and thalli. ↑ CONJUGANT

SB120 exconjugant (*n.*) An organism after it has taken part in conjugation, *e.g.* if two *Paramecium* individuals conjugate, when they separate they become exconjugants. ↑ CONJUGANT

SB121 gametangium (*n.,pl.* **gametangia**) **1** (In plants) a sexual organ in which gametes are produced. **2** The distal portion of an outgrowth from the hypha of a conjugating fungus, the proximal part being the suspensor. The gametangium produces isogametes. Two gametangia make contact, one from each of a plus and a minus strain of the fungus, the wall between them dissolves, and the isogametes fuse. Neither isogamete is transferred; the terms **plus** and **minus**, instead of male and female, are used to describe the type of hyphae. ↑ CONJUGATION → ISOGAMETE

SB122 microconjugant (*n.*) A motile, free-swimming, ciliated microgamete produced by some Protozoa; it is regarded as the male gamete; it attaches itself to and unites with a macroconjugant. ↓ MACROCONJUGANT (P) ↑ CONJUGATION → MICROGAMETE

SB123 macroconjugant (*n.*) A non-motile macrogamete produced by some Protozoa; it is regarded as the female gamete; it is the larger of a pair of uniting anisogametes and is fertilized by a microconjugant. ↑ MICROCONJUGANT (P) → MACROGAMETE

SB124 homothallism (*n.*) (In fungi) the

condition in which sexual reproduction or conjugation takes place between hyphae of the same mycelium, *i.e.* each thallus is self-fertile. —HOMOTHALLIC (*adj.*) ↓ HETEROTHALLISM (An) · MORPHOLOGICAL HETEROTHALLISM · PHYSIOLOGICAL HETEROTHALLISM ↑ CONJUGATION → THALLUS

SB125 heterothallism (*n.*) (In algae and fungi) the condition in which sexual reproduction takes place between two separate thalli. Each thallus is sexually self-sterile. In fungi it includes sexual reproduction in which both thalli possess sex organs and also conjugation from the fusion of hyphae, the thalli possessing no sex organs. —HETEROTHALLIC (*adj.*) ↑ HOMOTHALLISM (An)

SB126 morphological heterothallism (*n.*) (In fungi) heterothallism in which the thalli are differentiated into male and female. ↑ HOMOTHALLISM

SB127 physiological heterothallism (*n.*) (In fungi) heterothallism in which the thalli have no morphological differentiation and are usually labelled as plus and minus strains. ↑ HOMOTHALLISM

SB128 macronucleus (*n.,pl.* **macronuclei**) (In Ciliophorans) the larger of two nuclei; it is concerned with the vegetative, *i.e.* non-reproductive, processes of the cell. The macronucleus is polyploid and divides by constriction and disappearance of the nuclear membrane (amitosis). During the conjugation of two ciliophorans the macronucleus of each disappears. After separation of the conjugants, the fusion nucleus produces 4 macronuclei and a micronucleus in each of the exconjugants. By cell division and division of the micronucleus each exconjugant produces 4 daughter cells. —***macronuclear*** (*adj.*) ↓ MEGANUCLEUS · MICRONUCLEUS ↑ CONJUGATION → CILIOPHORA

SB129 meganucleus (*n.*) Alternative term for MACRONUCLEUS. —***meganuclear*** (*adj.*) ↑ MACRONUCLEUS

SB130 micronucleus (*n.,pl.* **micronuclei**) (In Ciliophorans) the smaller of two nuclei; it is concerned with the reproductive processes of the cell. The micronucleus is diploid and divides meiotically during conjugation to form haploid nuclei, 3 of which degenerate and the fourth divides mitotically to form a male migratory nucleus and a stationary female nucleus. These are the gametes for conjugation. The male nucleus of each conjugant migrates to its partner and unites with the female nucleus to form a fusion nucleus. The two conjugants then separate and form by cell division 4 daughter cells, each with a macronucleus and a micronucleus. —***micronuclear*** (*adj.*) ↑ MACRONUCLEUS

SB131 homothallic (*adj.*) **1** Describes a thallus possessing both male and female sex organs. **2** Describes fungi in which conjugation occurs between two hyphae from the same mycelium. —HOMOTHALLISM (*n.*) ↓ HETEROTHALLIC (An) ↑ CONJUGATION

SB132 heterothallic (*adj.*) **1** Describes a plant having thalli of different sexes or different strains (plus or minus). **2** Describes fungi in which sexual reproduction only occurs between two mycelia of opposite sex or opposite strain. —HETEROTHALLISM (*n.*) ↑ HOMOTHALLIC (An)

SB133 archegonium (*n.,pl.* **archegonia**) A female sex organ shaped like a bottle, with a neck and a swollen base (the venter); it contains one oosphere. It occurs in liverworts, mosses, ferns, and many gymnosperms. ↓ GAMETOTHALLUS · ASCOGONIUM · OOSPHERE · CARPOGONIUM · ANTHERIDIUM (An) ↑ SEXUAL REPRODUCTION · OOGONIUM

SB134 gametothallus (*n.*) A thallus which produces gametes. ↓ GAMETOCYST ↑ ARCHEGONIUM

SB135 gametocyst (*n.*) (In colonial Protozoa) a sac-like cyst in which two free forms of gametes fuse. ↑ GAMETOTHALLUS

SB136 ascogonium (*n.*) The oogonium of *Ascomycetes*, a penultimate cell on the archicarp; it may be uni-nucleated or multi-nucleated. ↓ ASCOCARP · ASCUS · ASCOSPORE ↑ ARCHEGONIUM

SB137 ascocarp (*n.*) (In *Ascomycetes*) a club-shaped antheridium (uni-nucleate or multi-nucleate) lying in contact with an archicarp. Male nuclei enter through a trichogyne into an ascogonium; there they fuse with female nuclei. Hyphae envelop the structure to form an ascocarp, the fruit body of the fungus. The ascocarp is named from its shape: cleistocarp (completely closed); perithecium (flask-shaped with a pore for discharge of spores); apothecium (cup-shaped). An ascocarp is the protective covering for an ascus. ↑ ASCOGONIUM → ARCHICARP

SB138 ascus (*n.,pl.* **asci**) A multinucleate cell developed from a fertilized ascogonium; it contains ascospores. ↑ ASCOGONIUM

SB139 ascospore (*n.*) One of the 8 spores usually found in an ascus. When ripe they are shed from the ascocarp; they grow and develop into a mycelium. ↑ ASCOGONIUM

SB140 oosphere (*n.*) A female gamete before fertilization, produced in an oogonium or in an archegonium; it is large, naked, non-motile, and spherical in shape. ↓ OOSPORE · ANTHEROZOID (An) ↑ ARCHEGONIUM

SB141 oospore (*n.*) **1** (In some Protozoa) an encysted zygote. **2** (In plants) a zygote or fertilized oosphere; it is either a thick-walled spore in a resting stage (as in algae and fungi) or a zygote obtaining nourishment from a prothallus (as in mosses, ferns, etc.) and developing into a new plant. ↑ OOSPHERE → ZYGOTE[1]

SB142 carpogonium (*n.,pl.* **carpogonia**) (In red algae) the female gametangium; a swollen basal portion contains the oosphere and at the apex there is an elongated, terminal projection, the trichogyne. ↓ CARPOSPORE ↑ ARCHEGONIUM

SB143 carpospore (*n.*) (In red algae) a spore produced by the union of the oosphere in a carpogonium and a spermatium; it is borne at the end of an outgrowth on the carpogonium. ↑ CARPOGONIUM

SB144 antheridium (*n.,pl.* **antheridia**) (In algae, fungi, Bryophyta and Pteridophyta) the male sex organ; it produces antherozoids. ↓ ANTHEROZOID · SPERMATOZOID · SPERMATIUM ↑ ARCHEGONIUM

SB145 antherozoid (*n.*) (In plants) a small, motile, flagellated male gamete; it is produced by an antheridium. Also called a ***spermatozoid***, or sometimes a ***sperm***. ↑ OOSPHERE (An) · ANTHERIDIUM

SB146 spermatozoid (*n.*) Alternative term for ANTHEROZOID (↑). ↑ OOSPHERE (An) · ANTHERIDIUM

SB147 spermatium (*n.,pl.* **spermatia**) (In red algae and fungi) a non-motile male gamete; it is produced in a spermagonium. It contains a single nucleus suspended from parietal cytoplasm in a central vacuole. ↑ ANTHERIDIUM → PARIETAL

SB148 spermagonium (*n.,pl.* **spermagonia**) A male sex organ which produces spermatia; it is either a flask-shaped capsule or a flattened, hollow capsule. ↑ ANTHERIDIUM

Asexual Reproduction

SC001 asexual reproduction (*n.*) Reproduction without specialized reproductive cells (gametes). It occurs in animals by binary fission or budding. In plants it is very important and includes all methods of vegetative reproduction, gemmation, and spore formation. ↓ SPOROGENESIS · SCHIZOGENESIS · SPORE · SPOROPHORE · GEMMA · VEGETATIVE REPRODUCTION → REPRODUCTION

SC002 sporogenesis (*n.*) The formation of spores. ↓ SPOROGONY · SPORULATION · GEMMATION · GEMMULATION · BUDDING[1] · BUDDING[2] · SPORE ↑ ASEXUAL REPRODUCTION

SC003 sporogony (*n.*) Alternative term for SPOROGENESIS (↑). ↑ SPOROGENESIS ↓ SPORE

SC004 sporulation (*n.*) **1** (In some Protozoa, such as *Plasmodium*) spore formation by multiple fission; after liberation the spores undergo development into a different form of the organism. **2** The liberation of spores for dispersal. ↑ SPOROGENESIS

SC005 gemmation (*n.*) The formation and development of gemmae by means of which new individuals are reproduced. ↑ SPOROGENESIS → GEMMA

SC006 gemmulation (*n.*) The formation of gemmules. ↑ SPOROGENESIS → GEMMULE

SC007 budding[1] (*n.*) (In unicellular plants, such as yeasts) a form of asexual reproduction in which a new cell is formed as an outgrowth of a parent cell. The daughter cell can detach itself or can remain to form a chain of cells by further budding. ↑ SPOROGENESIS

SC008 budding[2] (*n.*) (In coelenterates) asexual reproduction by the formation of buds, or gemmae. The buds have enterons connected with the parent enteron; this connection is eventually sealed off and the bud detaches itself when its tentacles have grown. Also known as ***gemmation***, but budding is the preferred term for coelenterates. ↑ SPOROGENESIS → GEMMA

SC009 schizogenesis (*n.*) Reproduction by fission. ↓ SCHIZOGONY (H) · SCHIZOGAMY ↑ ASEXUAL REPRODUCTION → BINARY FISSION (H)

SC010 schizogony (*n.*) Reproduction by multiple fission, as in certain Protozoa, such as *Plasmodium*. ↑ SCHIZOGENESIS

SC011 schizogamy (*n.*) (In some Polychaeta) fission of the body into one sexed and one unsexed offspring. ↑ SCHIZOGENESIS

SC012 spore (*n.*) A reproductive body consisting of one cell or several cells, formed by all plants, especially noticeable in ferns and fungi; also formed by bacteria, where it is a resistant, dormant form, and by some protozoans. A spore has the ability to separate from the parent and to produce directly or indirectly a new individual, but it never has in it an embryo, as in eggs or seeds. It is usually microscopic, can be in many different forms, produced in a variety of ways, and may be thick-walled or thin-walled. It has the important characteristics of being produced in very large numbers, of being readily dispersed, and of resisting adverse conditions if thick-walled, so that in favourable conditions it provides a rapid increase in the population of the species. A true spore is an asexual reproductive body with a haploid nucleus □ *spores germinate on suitable substrates; spores produce new individuals* —SPORIFEROUS (*adj.*) SPORIPAROUS (*adj.*) ↓ ARCHESPORIUM · SPORANGIOSPORE · ZOOSPORE (H) · MEGASPORE (H) · MICROSPORE (H) · SPORANGIUM SPORIFEROUS · HOMOSPOROUS ↑ ASEXUAL REPRODUCTION → HAPLOID · PROPAGULE

SC013 archesporium (*n.*) A cell or group of cells which divides to form sporoblasts and finally spores. ↓ SPOROBLAST · SPOROCYTE · SPORE MOTHER CELL ↑ SPORE

SC014 sporoblast (*n.*) A diploid cell giving rise to four haploid spores. ↑ ARCHESPORIUM

SC015 sporocyte (*n.*) Alternative term for a SPOROBLAST (↑).

SC016 spore mother cell (*n.*) Alternative term for SPOROBLAST (↑).

SC017 sporangiospore (*n.*) A spore formed in a sporangium. ↓ CONIDIUM · BASIDIOSPORE · ZOOSPORE · SPOROZOID · SPORE CASE · ZYGOSPORE · APLANOSPORE · PLANOSPORE

SPORANGIUM ↑ SPORE

SC018 conidium (*n., pl.* **conidia**) An asexual fungal spore formed by the constriction of a short hypha (a conidiophore); the conidia are oval-shaped and arranged in a chain above the hypha; the end conidium is detached and dispersed by wind, followed successively by the others. —***conidial*** (*adj.*) ***conidiferous*** (*adj.*) ↓ CONIDIOPHORE ↑ SPORANGIOSPORE

SC019 basidiospore (*n.*) A spore formed in a basidium. Sexual reproduction in the club-shaped basidium, followed by meiosis, produces four haploid basidiospores carried externally on minute stalks. ↑ SPORANGIOSPORE → BASIDIUM

SC020 zoospore (*n.*) (In many Protozoa, some algae, and some fungi) a naked cell, an asexual spore, which possesses cilia or one or more flagella causing it to be motile, or which is motile by amoeboid movement. Zoospores are differentiated from other spores solely by their motility. ↓ ZOOSPORANGIUM ↑ SPORANGIOSPORE

SC021 sporozoid (*n.*) Alternative term for ZOOSPORE (↑).

SC022 spore case (*n.*) The capsule enclosing a spore; also called a ***theca***. ↑ SPORANGIOSPORE

SC023 zygospore (*n.*) (In some algae and fungi) a thick-walled resting spore; it is produced by the union of the contents of two similar gametangia, *i.e.* by conjugation, or by the union of motile isogametes. ↑ SPORANGIOSPORE → ZYGOTE[1]

SC024 aplanospore (*n.*) A non-motile, resting spore of algae or an encysted spore of fungi; it is developed singly from a thallus cell or in numbers from within a sporangium. ↓ PLANOSPORE (An) ↑ SPORANGIOSPORE

SC025 planospore (*n.*) Alternative term for ZOOSPORE (↑). ↑ SPORANGIOSPORE · APLANOSPORE (An)

SC026 megaspore (*n.*) The larger of two types of unsexed spores, consisting of a single cell; in some ferns it develops into a prothallus bearing female sex organs; and in flowering plants it becomes an embryo sac. ↓ MACROSPORE (Sn) · MICROSPORE (P) ↑ SPORE → PROTHALLUS · EMBRYO SAC

SC027 macrospore (*n.*) An alternative term for MEGASPORE (↑).

SC028 microspore (*n.*) The smaller of two types of unsexed spores, consisting of a single cell; in some ferns it develops into a prothallus bearing male sex organs; and in flowering plants it becomes a pollen grain. ↑ MEGASPORE (P) → POLLEN GRAIN

SC029 sporangium (*n.,pl.* **sporangia**) A capsule-shaped organ in which spores are produced asexually. —***sporangial*** (*adj.*) ↓ BASIDIUM · ZOOSPORANGIUM · MEGASPORANGIUM · MACROSPORANGIUM · MICROSPORANGIUM · SOREDIUM · SPORANGIA ↑ SPORE

SC030 basidium (*n.,pl.* **basidia**) A specialized cell or group of four cells formed at the terminal ends of a basidiophore; it is club-shaped and possesses four haploid nuclei produced as the result of sexual reproduction in a binucleate terminal cell of a hypha (part of the basidiophore). Each haploid nucleus develops into a basidiospore. ↑ BASIDIOSPORE · SPORANGIUM

SC031 zoosporangium (*n., pl.* **zoosporangia**) A sporangium producing zoospores. ↑ ZOOSPORE · SPORANGIUM

SC032 megasporangium (*n., pl.* **megasporangia**) **1** (In some ferns) a sporangium producing megaspores. **2** (In flowering plants) a sporangium which becomes an ovule. ↓ MACROSPORANGIUM (Sn) · MICROSPORANGIUM ↑ MEGASPORE · SPORANGIUM (Cm) → OVULE

SC033 macrosporangium (*n., pl.* **macrosporangia**) An alternative term for MEGASPORANGIUM (↑). ↑ SPORANGIUM

SC034 microsporangium (*n., pl.* **microsporangia**) **1** (In some ferns) a sporangium producing microspores. **2** (In flowering plants) a pollen sac. ↑ MICROSPORE · SPORANGIUM · MEGASPORANGIUM (Cm) · MACROSPORANGIUM (Cm) → POLLEN SAC

SC035 soredium (*n., pl.* **soredia**) An organ of asexual reproduction, which is an outgrowth on the surface of a lichen; it is formed from a mass of fungal hyphae surrounding a minute cluster of algal cells. Soredia are formed in large numbers, become detached, and are dispersed by wind, water, and insects. ↑ SPORANGIUM → LICHENES

SC036 sporangia (*n.pl.*) The plural of SPORANGIUM. ↑ SPORANGIUM

SC037 sporiferous (*adj.*) Describes an organism bearing spores. ↓ SPOROID · SPORIPAROUS ↑ SPORE

SC038 sporoid (*adj.*) Spore-like. ↑ SPORIFEROUS

SC039 sporiparous (*adj.*) Describes reproduction by spores. —***sporiparity*** (*n.*) ↑ SPORIFEROUS

SC040 homosporous (*n.*) Describes a plant producing only one type of spore (the most common form of sporogenesis). ↓ HETEROSPOROUS (An) ↑ SPORE

SC041 heterosporous (*adj.*) Describes a plant producing microspores and megaspores. In ferns the difference in size of the spores is conspicuous; in seed plants there is less difference in size, the descriptions being applied because of the homologous nature of the spores with those of the ferns. ↑ MEGASPORE · MICROSPORE · HOMOSPOROUS (An)

SC042 sporophore (*n.*) (In fungi) a general description of a spore-bearing structure. ↓ SPORANGIOPHORE (H) · CONIDIOPHORE (H) · BASIDIOPHORE (H) · SPOROPHYLL · CAPILLITIUM ↑ ASEXUAL REPRODUCTION

SC043 sporangiophore (*n.*) A stalk-like structure arising from a mycelium, bearing on it one or more sporangia; the sporangiophore in some fungi is morphologically distinct from vegetative hyphae. It is a form of sporophore. ↓ CONIDIOPHORE · BASIDIOPHORE* · MUSHROOM · TOADSTOOL ↑ SPOROPHORE

SC044 conidiophore (*n.*) A specialized hypha with filaments bearing conidia. A conidium is cut off by constriction of the filament. It is a form of sporophore. ↑ SPORANGIOPHORE → CONIDIUM

SC045 basidiophore (*n.*) A sporophore which bears basidia; a short, thick, specialized hypha arising from the mycelium of some fungi. ↑ SPORANGIOPHORE → BASIDIUM

SC046 mushroom (*n.*) The fruiting body or sporophore, a type of basidiophore, of certain species of the Club Fungi or Basidiomycetes. The gills of the mushroom bear club-shaped basidia with each basidium giving rise to four basidiospores. Mushrooms are species of gill fungi. ↓ TOADSTOOL (Sn) ↑ SPORANGIOPHORE → GILLS[2]

SC047 toadstool (*n.*) The fruiting body or sporophore of certain species of Club Fungi, similar to a mushroom. Mushrooms are edible and toadstools are poisonous. ↑ SPORANGIOPHORE

SC048 sporophyll (*n.*) A leaf or modified leaf bearing sporangia. In some ferns sporophylls are undifferentiated from ordinary leaves; in other ferns a modified leaf bears the sporangia. In flowering plants the stamens and carpels are sporophylls □ *a sporophyll bears sporangia* ↓ MEGASPOROPHYLL · MACROSPOROPHYLL · MICROSPOROPHYLL (P) ↑ SPOROPHORE → STAMEN · CARPEL

SC049 megasporophyll (*n.*) **1** (In some ferns) a leaf or modified leaf bearing megasporangia. **2** (In flowering plants) a leaf or modified leaf which becomes a carpel. ↓ MACROSPOROPHYLL (Sn) · MICROSPOROPHYLL (P) ↑ SPOROPHYLL → MEGASPORANGIUM · CARPEL

SC050 macrosporophyll (*n.*) An alternative term for MEGASPOROPHYLL (↑).

SC051 microsporophyll (*n.*) **1** (In some ferns) a leaf or modified leaf bearing microsporangia. **2** (In flowering plants) a leaf or modified leaf which becomes a stamen. ↑ MICROSPORANGIUM · SPOROPHYLL · MEGASPOROPHYLL (Cm) · MACROSPOROPHYLL (Cm) → STAMEN

SC052 capillitium (*n.*) (In slime moulds) a network of filaments in which spores are entangled; the filaments arise from a stalk enclosed in a sporangium. ↓ PERIDIUM ↑ SPOROPHORE

SC053 peridium (*n.*) (In slime moulds) the wall of a sporangium. ↑ CAPILLITIUM

SC054 gemma (*n.,pl.* **gemmae**) An organ of asexual reproduction occurring in mosses, liverworts, coelenterates and ascidians. An outgrowth on the organism is formed from a group of cells; it develops into a new organism and becomes detached from the parent. In animals, gemmae are usually called buds, *e.g.* the buds on *Hydra*. —GEMMATION (*n.*) GEMMATE, GEMMACEOUS, GEMMIFEROUS, GEMMIFORM, GEMMIPAROUS (*adj.*) ↓ GEMMA-CUP · BUD[1] (H) GEMMACEOUS ↑ ASEXUAL REPRODUCTION → PROPAGULE · GEMMULATION

SC055 gemma-cup (*n.*) A receptacle or hollow in which gemmae are formed. The gemma-cup appears as a ridge on the surface of the individual. ↓ GEMMULE · BUD[1] · TURION ↑ GEMMA

SC056 gemmule (*n.*) A small bud, arising asexually as a group of cells, formed internally in sponges; the gemmule develops after the death of the parent when conditions are less adverse. —***gemmulation*** (*n.*) ↑ GEMMA-CUP

SC057 bud[1] (*n.*) See GEMMA (↑).

SC058 turion (*n.*) A detached bud produced by water plants; it is capable of surviving winter or other adverse conditions. ↑ GEMMA-CUP

SC059 gemmaceous (*adj.*) Of or to do with gemmae or buds. ↓ GEMMATE · GEMMIFEROUS · GEMMIPAROUS · GEMMIFORM ↑ GEMMA

SC060 gemmate (*adj.*) Bearing gemmae or buds. ↑ GEMMACEOUS

SC061 gemmiferous (*adj.*) Having the disposition to bear gemmae or buds. ↑ GEMMACEOUS

SC062 gemmiparous (*adj.*) Reproducing by gemmae or buds. —***gemmiparity*** (*n.*) ↑ GEMMACEOUS

SC063 gemmiform (*adj.*) Having the shape of a bud or gemma. ↑ GEMMACEOUS

SC064 vegetative reproduction (*n.*) Asexual reproduction in plants by means of root, stem or leaves (vegetative parts) in which detachment of some part of the plant body occurs; it does not include reproduction by spores but includes gemmation. The part of the plant, such as the gemma, rhizome, bulb, etc., develops into a complete plant. The simplest form of vegetative reproduction occurs in filamentous algae and in fungi where the filament or mycelium is broken and the separate pieces continue to grow. The advantages of vegetative reproduction are, ***a*** rapid colonization of a small area; ***b*** the offspring are genetically the same as the parent, which is important in plant breeding for the maintenance of strains once a particular strain has been selected. ↓ RHIZOME · STOLON · PHYTOMER · PROPAGATION[1] ↑ ASEXUAL REPRODUCTION → VEGETATIVE PROPAGATION

SC065 rhizome (*n.*) A horizontal, underground stem which acts as a means of vegetative reproduction and may also act as a food-storage organ, in which case it is swollen. It bears buds in the axils of scale leaves and adventitious roots below the axils. Aerial shoots grow from the buds. It serves as a means of perennation. Examples of plants with rhizomes are ginger, canna, fern and *Imperata*. ↓ TUBER · CORM · BULB · SUCKER[1] ↑ VEGETATIVE PROPAGATION → PERENNATION · SCALE LEAF

SC066 tuber (*n.*) The swollen end of an underground stem (a stem tuber), bearing buds on the surface, in the axil of scale leaves; the tuber acts as a food store and each bud can grow into a new individual plant, *e.g.* the European potato. A root tuber is a swollen root acting as a food-

storage organ with a small stem at its upper end; buds on the stem develop into a new individual plant, *e.g.* the dahlia and sweet potato. ↑ RHIZOME

SC067 corm (*n.*) A solid, underground stem, rounded in shape, possessing two or more internodes and covered with a few membranous scale leaves. Buds grow in the axils of the scale leaves and develop into aerial shoots. After flowering, new corms are formed at the base of the aerial shoot. The corm acts as an organ of vegetative reproduction and also as a food store, *e.g. Gladiolus, Colocasia.* ↑ RHIZOME

SC068 bulb (*n.*) A specialized underground organ of vegetative reproduction; it consists of a very short, thick, much reduced stem surrounded by fleshy scale leaves, with adventitious roots growing from the rim of the stem. Buds arise in the axils of the fleshy scale leaves and send up aerial shoots. After flowering, new bulbs are formed at the base of the aerial shoot. Food is stored in the fleshy scale leaves, *e.g.* the onion, the lily. ↑ RHIZOME

SC069 sucker[1] (*n.*) A shoot from an underground stem which becomes an aerial shoot, usually some distance away from the main stem. It may develop roots and become a separate individual plant, *e.g.* as with mint, banana, and pineapple. Suckers are used in vegetative propagation. ↑ RHIZOME · VEGETATIVE PROPAGATION

SC070 stolon (*n.*) A horizontal stem growing above ground that may form roots at the nodes. New individual plants may develop from the rooted nodes, *e.g.* as with the strawberry. ↓ RUNNER · BULBIL ↑ VEGETATIVE REPRODUCTION

SC071 runner (*n.*) A stolon that roots at the tip; a new individual grows at the rooted portion and the runner decays, *e.g. Convolvulus,* sweet potato, and carpet grass. ↑ STOLON

SC072 bulbil (*n.*) A tiny fleshy bulb arising in the axil of leaves on aerial stems. The bulbil when mature becomes detached, falls to the ground, and generates a new plant, *e.g.* as with sisal and wild yam. ↑ STOLON

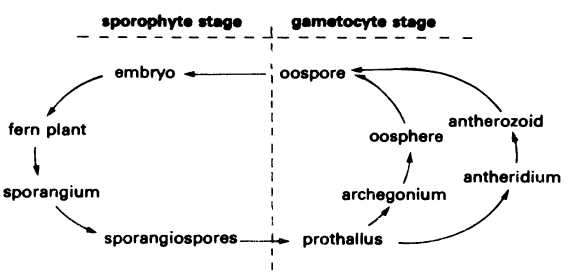
SC073 phytomer (*n.*) The smallest structural unit of a plant which is capable of reproducing vegetatively. Compare **propagule**: in phytomer the focus is on the parent plant; in propagule the focus is on the function of propagation. ↓ PROPAGULE ↑ VEGETATIVE REPRODUCTION

SC074 propagation[1] (*n.*) The spreading of successive generations of plants from an individual parent plant. The natural modes of spreading are by the dispersal of spores, seeds, or gemmae, or by the growth of vegetative organs of the plant. Artificial propagation is used in horticulture. —PROPAGATE (*v.*) PROPAGULE (*n.*) ↓ PROPAGULE ↑ VEGETATIVE REPRODUCTION → TRANSPLANT · DISPERSAL (H)

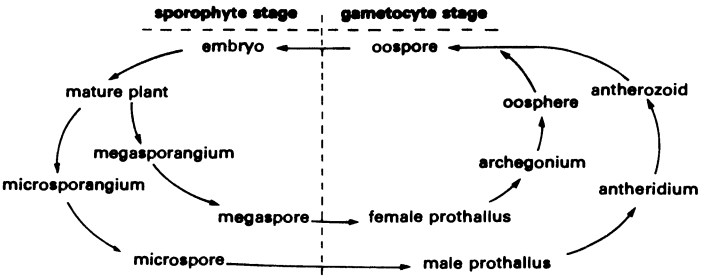
SC075 horticultural propagation (*n.*) Propagation effected artificially by planting cuttings, layering, budding, grafting, or by marcotting. ↑ PROPAGATION → LAYERING · GRAFTING

SC076 propagule (*n.*) Any part of a plant suitable for propagation, *e.g.* a spore, a seed, a gemma, a part such as a rhizome, a bulb, a cutting, etc., are all propagules. ↑ PROPAGATION[1] → SEED[2]

Alternation of Generations

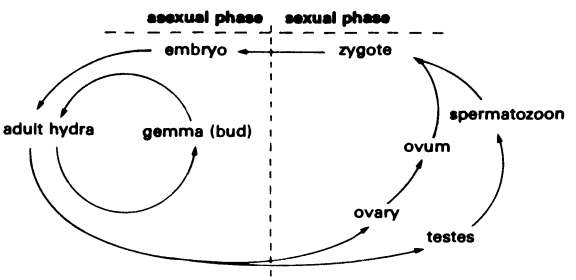


HOMOSPOROUS CYCLE

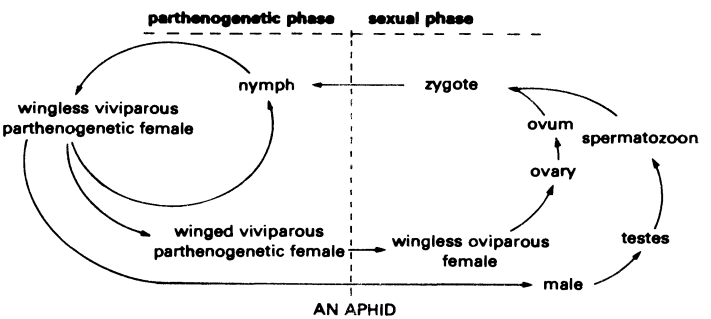


HETEROSPOROUS CYCLE

ALTERNATION OF GENERATIONS IN PLANTS



A COELENTERATE



AN APHID

ALTERNATION OF GENERATIONS IN ANIMALS

SD001 alternation of generations (*n.*) The occurrence of two or more forms of an organism with different forms of reproduction in its life-cycle. The generations which complete a life-cycle usually alternate between a form of sexual reproduction and a form of asexual reproduction. The asexual generation is usually diploid and the sexual generation is haploid. The asexually and the sexually reproducing forms are frequently quite different. The phenomenon occurs in many algae and in all other plants. Two cycles for plants are shown in diagrammatic form. The phenomenon also occurs in

invertebrate animals, *e.g.* some coelenterates, tapeworms, and some arthropods, such as aphids. In animals, the asexual stage is either parthenogenetic, as in aphids, or gemmiparous, as in *Hydra*. In the asexual phases, an asexual cycle continues while conditions are favourable. ↓ SPOROPHYTE · PROTHALLUS · SPERMATOPHYTE · DIMORPHISM · HETEROGENESIS · MONOCARPIC[1] · MONOMORPHIC · ANTITHETIC · SPOROCYST · ONCHOSPHERE · DOUBLE FERTILIZATION · OVULE · POLLINATION · SEED[2] → REPRODUCTION

SD002 sporophyte (*n.*) The stage of the life-cycle of a plant which has diploid nuclei and produces spores. This is the asexually reproducing stage and haploid spores are produced by meiosis from diploid nuclei. The haploid spores develop into gametophytes. —***sporophytic*** (*adj.*) ↓ GAMETOPHYTE (P) · GAMETOPHORE ↑ ALTERNATION OF GENERATIONS → DIPLOID · MEIOSIS

SD003 gametophyte (*n.*) The stage of the life-cycle of a plant which has haploid nuclei and produces gametes. The union of the gametes produces a zygote, zygospore, oospore, etc., with diploid nuclei; these develop into the sporophyte generation. —***gametophytic*** (*adj.*) ↑ SPOROPHYTE (P)

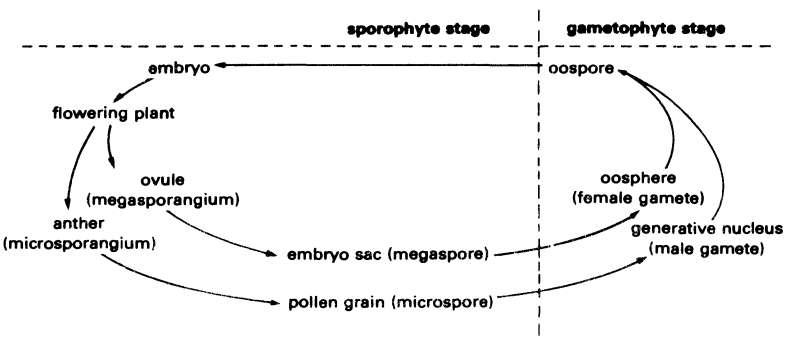
SD004 gametophore (*n.*) The specialized part of a gametophyte on which gametangia are found. ↑ SPOROPHYTE → SPOROPHORE

SD005 prothallus (*n.*) The gametophyte of Pteridophyta (ferns, etc.), the haploid sexual generation developed from spores. It is a small, green, parenchymatous thallus, bearing sex organs (antheridia and archegonia) on its lower surface. ↓ STROBILUS · CONE[2] ↑ ALTERNATION OF GENERATIONS → ANTHERIDIUM · ARCHEGONIUM

SD006 strobilus (*n.*) A reproductive organ, bearing spores or seeds, consisting of tightly packed sporophylls grouped on a central axis; also called **cone**, *e.g.* the spore-bearing strobilus (cone) of a horsetail (Equisetales); the strobilus (cone) of a pine tree bears seeds □ *a strobilus bears seeds* ↑ PROTHALLUS

SD007 cone[2] (*n.*) Alternative term for STROBILUS (↑), especially for gymnosperms.

SD008 spermatophyte (*n.*) A seed plant,



LIFE CYCLE OF A FLOWERING PLANT

such as a tree, a shrub, a herbaceous plant or grass; all possess stems, roots, leaves and a well-developed vascular system. They are heterosporous with dominant sporophyte generations and greatly reduced gametophyte generations The term includes Gymnospermae (with naked ovules) and Angiospermae (with ovules in ovaries). —***spermatophytic*** (*adj.*) ↓ SPERMAPHYTE · ANNUAL[2] · BIENNIAL[2] · PERENNIAL[2] · HERBACEOUS PERENNIAL · WOODY PERENNIAL · EPHEMERAL[1] · PERENNATION ↑ ALTERNATION OF GENERATIONS

SD009 spermaphyte (*n.*) Alternative term for SPERMATOPHYTE (↑).

SD010 annual[2] (*n.*) A plant that completes its life-cycle from seed germination to seed production in one season; in temperate climates this is once a year The plant then dies. —ANNUAL (*adj.*) ↑ SPERMATOPHYTE

SD011 biennial[2] (*n.*) A plant that completes its life-cycle in two seasons; in temperate climates this takes two years. The plant manufactures and stores food in storage organs in the first season and then forms flowers and produces seeds in the second season. —BIENNIAL (*adj.*) ↑ SPERMATOPHYTE

SD012 perennial[2] (*n.*) A plant that continues to grow season after season, or year after year, producing flowers and seeds each season. —PERENNATION (*n.*) PERENNIAL (*adj.*) ↑ SPERMATOPHYTE

SD013 herbaceous perennial (*n.*) A plant with an underground stem that persists perennially but develops aerial shoots that die at the end of the season, and are replaced by new shoots the next season. ↑ SPERMATOPHYTE

SD014 woody perennial (*n.*) A plant with a

woody stem that persists above ground season after season. The stem provides a new growing point for each season's growth, *e.g.* shrubs and trees; this characteristic permits them to grow to a great size. ↑ SPERMATOPHYTE

SD015 ephemeral[1] (*n.*) A plant that completes several life-cycles from seed germination to seed production in one season, thus having several generations in one year. —EPHEMERAL (*adj.*) ↑ SPERMATOPHYTE

SD016 perennation (*n.*) The survival of an individual plant for a number of seasons or a number of years by vegetative means, *e.g.* ***a*** as in herbaceous plants with underground stems and aerial shoots; ***b*** as in woody perennials. ↑ SPERMATOPHYTE

SD017 dimorphism (*n.*) The phenomenon of a plant which can exist in two different forms of the same generation, *e.g.* ***a*** yeast growing as separate cells or as multinucleate hyphae; ***b*** male and female animals. ↓ POLYMORPHISM[2] ↑ ALTERNATION OF GENERATIONS

SD018 polymorphism[2] (*n.*) The phenomenon of existing in several different forms, usually with a fairly constant ratio between the forms, *e.g.* ***a*** human blood groups; ***b*** a species of coloured plant with several different-coloured flowers. • The different forms arise from different genes of an allelomorphic set. The occurrence of castes in social insects is a special case of polymorphism. The term does not include metamorphosis. ↑ DIMORPHISM → METAMORPHOSIS · GENE · ALLELOMORPH · CASTE (H)

SD019 heterogenesis (*n.*) Alternative term for ALTERNATION OF GENERATIONS. ↓ METAGENESIS · HETEROGAMY · HETEROGENY ↑ ALTERNATION OF GENERATIONS

SD020 metagenesis (*n.*) Alternation of sexual and asexual generations. —***metagenetic*** (*adj.*) ↑ HETEROGENESIS

SD021 heterogamy (*n.*) **1** Alternation in two successive generations of two different forms of sexual reproduction in animals, one being true sexual and the other parthenogenetic, *e.g.* ***a*** in some aphids, syngamy followed by parthenogenesis; ***b*** in some nematodes, a dioecious generation followed by a hermaphrodite generation. **2** Alternative term for ANISOGAMY. —***heterogamous*** (*adj.*) ↑ HETEROGENESIS → SYNGAMY · PARTHENOGENESIS · HERMAPHRODITE · DIOECIOUS · ANISOGAMY

SD022 heterogeny (*n.*) The condition of an organism having several distinct generations not resembling one another, with the generations succeeding each other in a lineal series, *e.g.* there are more than two generations in the alternation of generations, as in aphids ↑ HETEROGENESIS

SD023 monocarpic[1] (*adj.*) (Of spermatophytes) fruiting once only in its lifetime. —***monocarp*** (*n.*) ↓ POLYCARPIC[1] · EPHEMERAL[2] ↑ ALTERNATION OF GENERATIONS → MONOCARPOUS

SD024 polycarpic[1] (*adj.*) (Of spermatophytes) producing fruit, season after season, *i.e.* a perennial. —***polycarp*** (*n.*) ↑ MONOCARPIC[1]

SD025 ephemeral[2] (*adj.*) Describes an organism having a very short life, *e.g.* the life of the butterfly lasts one day only. ↑ MONOCARPIC[1]

SD026 monomorphic (*adj.*) Having only one form, developing with no or very slight changes. ↓ DIMORPHIC (An) · POLYMORPHIC[2] (An) · HETEROMORPHIC (An) · ISOMORPHIC ↑ ALTERNATION OF GENERATIONS

SD027 dimorphic (*adj.*) Describes a plant exhibiting dimorphism. —DIMORPHISM (*n.*) ↑ MONOMORPHIC · DIMORPHISM

SD028 polymorphic[2] (*adj.*) Describes an organism, or part of an organism, that exhibits polymorphism. ↑ MONOMORPHIC

SD029 heteromorphic (*adj.*) (In plants, particularly algae) describes alternating generations which are vegetatively dissimilar. —***heteromorphism*** (*n.*) ↓ ISOMORPHIC (An) ↑ MONOMORPHIC

SD030 isomorphic (*adj.*) (In plants, particularly algae) describes alternating generations which are vegetatively identical. —***isomorphism*** (*n.*) ↓ MONOMORPHIC · HETEROMORPHIC (An)

SD031 antithetic (*adj.*) Describes the alternation of haploid and diploid generations. ↑ ALTERNATION OF GENERATIONS → DIPLOID

SD032 sporocyst (*n.*) **1** (In Sporozoa) a stage in spore formation developed from an oocyst before the release of sporozoites. **2** The protective covering round a spore of Protozoa. **3** (In flukes) a sac-shaped, encysted embryo stage in the secondary or intermediate host. ↓ SPOROZOITE · POLYP · LARVA[2] · POLYPOID · ONCHOSPHERE ↑ ALTERNATION OF GENERATIONS

SD033 sporozoite (*n.*) A spore phase in the life-cycle of Sporozoa; it is liberated from a sporocyst when its membrane dissolves; they are usually motile, thin, spindle-shaped rods. Sporozoites are formed from spores by cell division; the spores are formed by division from sporoblasts in an oocyst. ↓ TROPHOZOITE · SCHIZONT · MEROZOITE · SCHIZOZOITE · SPORONT · GAMONT ↑ SPOROCYST

SD034 trophozoite (*n.*) (In Sporozoa) the adult stage of the asexual phase in the alternation of generations; it develops from a merozoite in a cell of the secondary host. ↑ SPOROZOITE

SD035 schizont (*n.*) (In Sporozoa) a multinucleate cell formed from a trophozoite; it undergoes multiple fission (schizogony) to form merozoites, the cell being segmented before fission. ↑ SPOROZOITE

SD036 merozoite (*n.*) A spore formed from a schizont; part of the asexual phase of the alternation of generations of Sporozoa. ↑ SPOROZOITE

SD037 schizozoite (*n.*) A merozoite formed from one segment of a schizont by multiple fission. ↑ SPOROZOITE

SD038 sporont (*n.*) (In Sporozoa) the gametocyte stage in its life-cycle; the gametocytes form male and female gametes. ↑ SPOROZOITE

SD039 gamont (*n.*) Alternative term for SPORONT (↑).

SD040 polyp (*n.*) **1** A simple, sedentary coelenterate with a mouth and tentacles at one end of a cylindrical trunk. Many polyps reproduce by budding, some by sexual reproduction as well, such as *Hydra*, and others by producing medusae, such as sea-anemone. **2** Also a term for a separate zooid of a colony and the sedentary asexual phase in the alternation of generations of some coelenterates. —POLYPOID (*adj.*) ↓ MEDUSA · HYDROID · MEDUSOID[1] · SCYPHISTOMA ↑ SPOROCYST

SD041 medusa (*n., pl.* **medusae**) A free-swimming stage in the life-cycle of some coelenterates; it is produced by budding from a polyp. Medusae reproduce sexually and form the sexual phase of the life-cycle of coelenterates. They are bell-shaped or umbrella-shaped, with male and female gonads suspended in the cavity of the body. The zygote formed by union of gametes develops into a polyp. Typical jelly-fish are large medusae and in some species are the only form of the coelenterate; in other species there is a polyp phase. —MEDUSOID (*n.*) MEDUSOID (*adj.*) ↑ POLYP

SD042 hydroid (*n.*) Describes a Hydrozoan in which the polypoid, or hydroid generation, is conspicuous and the medusoid generation is reduced, *e.g. Obelia.* —HYDROID (*adj.*) ↓ MEDUSOID[1] (An) ↑ POLYP → HYDROZOA

SD043 medusoid[1] (*n.*) Describes a Hydrozoan in which the medusoid generation of the life-cycle is conspicuous, and the hydroid or polypoid generation is reduced, *e.g.* some jelly-fish. ↑ POLYP · HYDROID (An)

SD044 scyphistoma (*n., pl.* **scyphistomae**) The polyp stage in scyphozoan coelenterates, such as jelly-fish; usually a small and insignificant sedentary organism. It gives rise to the medusoid stage by horizontal division or splitting. ↑ POLYP

SD045 larva[2] (*n., pl.* **larvae**) (In flukes) an embryo which is independent and self-sustaining; it exists in several different forms at different stages of the asexual stage of the life-cycle. ↓ MIRACIDIUM · REDIA · CERCARIA · PLANULA · TADPOLE ↑ SPOROCYST → TREMATODA

SD046 miracidium (*n., pl.* **miracidia**) (In flukes) a free-living, ciliated larva which hatches from eggs which have been released from a vertebrate host in excreta. It is the first stage of the asexual cycle and it swims to its host (a snail) in which the larva forms a sporocyst. ↑ LARVA[2]

SD047 redia (*n , pl.* **rediae**) (In flukes) a parasitic larva in an intermediate host, produced from a sporocyst. The rediae reproduce asexually to form more rediae or cercariae. It occurs in liver flukes but not in blood flukes. ↑ LARVA[2] → FLUKE[2]

SD048 cercaria (*n., pl.* **cercariae**) (In flukes) a motile, free-living larva with a simple or a bifid tail; it is produced asexually from a redia or a sporocyst. It seeks and enters a primary host or an intermediate host. A stage of asexual development in the life-cycle. ↑ LARVA[2] → FLUKE[2]

SD049 planula (*n.*) A free-swimming larva of coelenterates; flat and ovoid in shape with an outer layer of ciliated cells. ↑ LARVA[2]

SD050 tadpole (*n.*) The larval stage of a frog or toad; it is long-tailed, possesses gills, and is aquatic throughout the larval stage. Hind-legs develop before fore-legs, the tail finally degenerates and is absorbed into the body before the tadpole becomes an adult frog. ↑ LARVA[2]

SD051 polypoid (*adj.*) Of, to do with, or like, a polyp. ↑ SPOROCYST · MEDUSOID[1]

SD052 medusoid[2] (*adj.*) Of, to do with, or like, a medusa. ↑ POLYPOID

SD053 onchosphere (*n.*) A six-hooked embryo which develops from the fertilized eggs of a Cestode. It is covered by a protective shell, which is dissolved by the digestive juices of the secondary host, releasing the embryo. The embryo develops into the particular larval form of the species. It is the first stage of the asexual phase of the alternation of generations. ↓ HEXACANTH · CYSTICERCUS · CYSTICERCOID · PLEROCERCOID · BLADDERWORM · PROSCOLEX · SCOLEX ↑ SPOROCYST → CESTODA

SD054 hexacanth (*n.*) Alternative term for ONCHOSPHERE.

SD055 cysticercus (*n., pl.* **cysticerci**) (In some Cestodes, such as tapeworms) the larval form found in a secondary host; it consists of a proscolex invaginated in a large bladder. ↑ ONCHOSPHERE

SD056 cysticercoid (*n.*) (In some Cestodes) the larval form in a secondary host, consisting of a proscolex in a small bladder. ↑ ONCHOSPHERE

SD057 plerocercoid (*n.*) (In some cestodes) the larval stage in a secondary host with no bladder present, the whole structure being solid. ↑ ONCHOSPHERE

SD058 bladderworm (*n.*) Alternative term for CYSTICERCUS or CYSTICERCOID (↑).

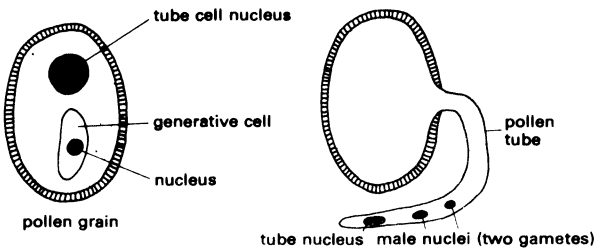
SD059 proscolex (*n., pl.* **proscolices**) A fluid-filled invagination in a bladderworm; it resembles a scolex turned inside out, *i.e.* invaginated. ↑ ONCHOSPHERE

SD060 scolex (*n., pl.* **scolices**) The anterior part or head of a Cestode, attached by suckers or by hooks to the wall of the intestine of a primary host. The segments (proglottides) of the tapeworm are budded off from the narrow neck behind the main structure of the scolex. —***scolecoid, scoleciform*** (*adj.*) ↑ ONCHOSPHERE → ROSTELLUM · PROGLOTTIS

SD061 double fertilization (*n.*) A characteristic of the angiosperms. A pollen tube grows down the style, through the micropyle and through the nucellus into the embryo-sac. The tube nucleus disintegrates. One male nucleus fuses with the oosphere

to form a zygote; the second nucleus fuses with the central fusion nucleus to form an endosperm nucleus. Contrast with fertilization in ***gymnosperms***: pollen grains are pulled through the micropyle by a resinous fluid exuded by the ovule; a pollen tube grows and penetrates the archegonium and a single male nucleus fuses with the oosphere to form a zygote. ↓ POLLEN TUBE ↑ ALTERNATION OF GENERATIONS

SD062 pollen tube (*n.*) A very fine tube formed when a pollen grain germinates. In angiosperms the pollen tube contains a tube nucleus at the tip and a generative nucleus further behind; the generative nucleus divides to form two male nuclei, non-motile microgametes. On entering the embryo-sac, the tube ruptures, the tube nucleus disintegrates and the two male nuclei are set free. In gymnosperms the pollen tube contains a tube nucleus at the tip, and a stalk cell and a body cell, both of which have been formed by division from the generative cell. The nucleus of the body cell divides to form two non-motile male microgametes. On entering an archegonium, a single male microgamete fuses with the oosphere; the other male microgamete, the tube nucleus, and the stalk cell, all disintegrate □ *a pollen tube ruptures at the tip; a pollen tube grows down a style* ↓ POLLEN GRAIN ↑ DOUBLE FERTILIZATION

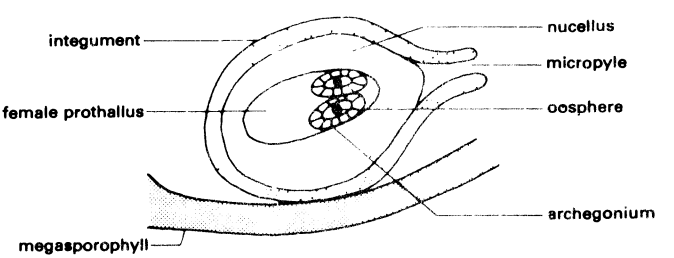


POLLEN GRAIN

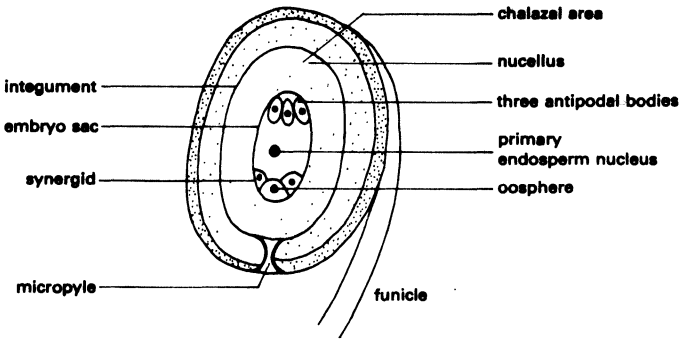
SD063 pollen grain (*n.*) A single structure, representing the male gametophyte. A mature pollen grain consists of a small generative cell, containing a generative nucleus, enclosed in a larger cell containing a tube nucleus. The grains of angiosperms are surrounded by a thick cuticularized outer wall (**extine**) and a thin, inner cellulose wall (**intine**). The grains of gymnosperms have swellings on the outer wall which act as floats. Four pollen grains are produced in one spore mother cell □ *pollen grains germinate on the surface of a stigma* ↑ POLLEN TUBE → POLLEN

SD064 ovule (*n.*) A structure found in conifers and flowering plants. It is surrounded by an integument, except at the micropyle, and contains a nucellus. In conifers the ovule is naked and attached to a megasporophyll (a cone); the nucellus surrounds a female prothallus, or megagametophyte, which contains two or three archegonia, each of which contains an oosphere. In flowering plants, one or more ovules are attached to the carpel wall, and the carpel encloses and protects the ovule. The nucellus surrounds an embryo sac. The ovule has developed from a megasporangium. ↓ FUNICLE · EMBRYO SAC · ANATROPOUS ↑ ALTERNATION OF GENERATIONS → ANTHER (P)

SD065 funicle (*n.*) (In angiosperms) the stalk attaching an ovule to a placenta; it leaves a scar when the fertilized ovule becomes a seed and is detached from the placenta. —***funicular*** (*adj.*) ↓ FUNICULUS[1] · RAPHE[2] INTEGUMENT[2] · MICROPYLE · NUCELLUS · CHALAZA[1] · FUNICULI ↑ OVULE



(a) OVULE OF GYMNOSPERM



(b) OVULE OF ANGIOSPERM

SD066 funiculus[1] (*n,pl.* **funiculi**) Alternative term for FUNICLE (↑).

SD067 raphe[2] (*n.*) A seam-like suture found on anatropous ovules, marking the position where the funicle adheres to the integument. ↓ ANATROPOUS ↑ FUNICLE

SD068 integument[2] (*n.*) (In spermatophytes) a layer enclosing the nucellus of an ovule; it arises from the chalazal end of the ovule and extensions of the integument form a micropyle at the apex of the ovule. In gymnosperms there is one integument; in angiosperms there is an inner and an outer integument. The integument develops after fertilization into the seed coat. ↑ FUNICLE

SD069 micropyle (*n.*) (In the ovule of seed plants) a tiny canal above the apex of the nucellus, formed by an extension of the integument. A pollen tube grows through it before the ovule can be fertilized. The micropyle remains in the testa of a seed, where it becomes a minute pore through which water enters for the seed to germinate. ↑ FUNICLE → TESTA

SD070 nucellus (*n.*) The central tissue of an ovule, enclosing the female prothallus in gymnosperms and the embryo sac in angiosperms. The nucellus has evolved from a megasporangium; it is a nutritional tissue for the embryo. ↑ FUNICLE

SD071 chalaza[1] (*n.*) (In angiosperms) the base of the nucellus. The integuments arise from the chalaza and the funicle is attached to the ovule at the chalaza, or chalazal region. —***chalazal*** (*adj.*) ↑ FUNICLE

SD072 funiculi (*n.pl.*) See FUNICULUS (↑).

SD073 embryo sac (*n.*) (In angiosperms) a large oval cell, the megaspore, *i.e.* the female gametophyte. Initially, it contains one haploid nucleus; this divides to form eight haploid nuclei. Three nuclei are sited at the micropyle end of the embryo sac, one of these develops into an oosphere and the other two into synergidae. Two nuclei are sited in the centre and these fuse to form a diploid primary endosperm nucleus. The remaining three nuclei are sited at the end of the embryo sac opposite to the micropyle; these develop into three antipodal cells. ↓ SYNERGID · PRIMARY ENDOSPERM NUCLEUS · FUSION NUCLEUS · ANTIPODAL CELL ↑ OVULE → MEGASPORE · OOSPHERE

SD074 synergid (*n.,pl.* **synergidae**) Two synergidae are sited at the apex of the ovule on either side of the oosphere. They guide the male nucleus from the pollen tube to the oosphere. After fertilization of the ovule, they become disorganized into the cytoplasm of the embryo sac and aid in the nourishment of the young embryo. ↑ EMBRYO SAC

SD075 primary endosperm nucleus (*n.*) A diploid nucleus in the centre of the embryo sac; it fuses with the second male nucleus from the pollen tube to form a triploid endosperm nucleus. ↑ EMBRYO SAC → TRIPLOID

SD076 fusion nucleus (*n.*) Alternative term for PRIMARY ENDOSPERM NUCLEUS.

SD077 antipodal cell (*n.*) Three antipodal cells are sited at the chalazal end of the embryo sac. After fertilization of the ovule, they become disorganized into the cytoplasm of the embryo sac and aid in the nourishment of the young embryo. ↑ EMBRYO SAC

SD078 anatropous (*adj.*) Describes an ovule in which the micropyle is near the funicle (the most common arrangement). The ovule is bent over and its body is united to the funicle. ↓ ORTHOTROPOUS · CAMPYLOTROPOUS ↑ OVULE

SD079 orthotropous (*adj.*) Describes an ovule in which the micropyle is directly opposite the funicle, on the far side of the ovule; the ovule is erect on the funicle and the micropyle points away from the placenta. ↑ ANATROPOUS

SD080 campylotropous (*adj.*) Describes an ovule in which the micropyle is between the anatropous and the orthotropous positions; the ovule is bent over so that the funicle is united to the body of the ovule for part of the way between the chalaza and the micropyle. ↑ ANATROPOUS

SD081 pollination (*n.*) The transference of pollen from anthers to stigmas. The main agents of pollination are wind and insects although a few plants have water as the pollinating agent. Contrast **fertilization** which is the subsequent process after the pollen has germinated on a stigma. —***pollinate*** (*v.*) ↓ CROSS-POLLINATION · DIOECISM · PISTILLATE · HYDROPHILOUS · GYNODIOECIOUS ↑ ALTERNATION OF GENERATIONS

SD082 cross-pollination (*n.*) Pollen is transferred from the anther of one individual plant to the stigma of another individual plant. This ensures sexual reproduction between two individuals, with all its advantages. ↓ SELF-POLLINATION (An) · ANEMOPHILY · ENTOMOPHILY ↑ POLLINATION → PROTANDROUS

SD083 self-pollination (*n.*) Pollen is transferred from an anther to a stigma of the same individual plant. This is not sexual reproduction between two individuals and many flowers have mechanisms to prevent self-pollination taking place. ↓ PROTANDRY ↑ CROSS-POLLINATION (An) → AUTOGAMY

SD084 anemophily (*n.*) Cross-pollination with wind as the pollinating agent. —***anemophilous*** (*adj.*) ↑ CROSS-POLLINATION

SD085 entomophily (*n.*) Cross-pollination with insects as agents of pollination. —***entomophilous*** (*adj.*) ↑ CROSS-POLLINATION

SD086 dioecism (*n.*) A condition in which individual plants bear either male or female flowers but not both; this ensures cross-pollination. —DIOECIOUS (*adj.*) ↓ PROTANDRY · PROTOGYNY ↑ POLLINATION

SD087 protandry (*n.*) A condition in which stamens ripen before the stigma matures. This is the most common mechanism to prevent self-fertilization. —PROTANDROUS (*adj.*) ↓ PROTOGYNY (An) ↑ DIOECISM

SD088 protogyny (*n.*) A condition in which stigmas mature before anthers ripen ↑ DIOECISM · PROTANDRY (An)

SD089 pistillate (*adj.*) (Of flowers) bearing carpels but no stamens, *i.e.* a female flower. Contrast **carpellate** meaning possessing carpels. ↓ STAMINATE (P) · ANANDROUS · SYNOECIOUS ↑ POLLINATION → CARPELLATE

SD090 staminate (*adj.*) (Of flowers) bearing stamens but no carpels, *i.e.* a male flower. ↑ PISTILLATE (P) → STAMINIFEROUS

SD091 anandrous (*adj.*) Describes a flower without stamens. ↑ PISTILLATE → STAMEN

SD092 synoecious (*adj.*) **1** Bearing male and female flowers on the same capitulum. **2** Bearing stamens and pistil on the same flower. ↑ PISTILLATE

SD093 hydrophilous (*adj.*) Describes a flower pollinated through the agency of water. ↑ POLLINATION

SD094 gynodioecious (*adj.*) Bearing female and hermaphrodite flowers on separate individual plants, *i.e.* individuals bear either female or hermaphrodite flowers ↓ ANDRODIOECIOUS (P) · GYNOMONOECIOUS · ANDROMONOECIOUS ↑ POLLINATION

SD095 androdioecious (*adj.*) Bearing male and hermaphrodite flowers on separate individual plants, *i.e.* individuals bear either male or hermaphrodite flowers. ↑ GYNODIOECIOUS (P)

SD096 gynomonoecious (*adj.*) Bearing both female and hermaphrodite flowers on the same individual plant. ↓ ANDROMONOECIOUS (P) ↑ GYNODIOECIOUS

SD097 andromonoecious (*adj.*) Bearing male and hermaphrodite flowers on the same individual plant. ↑ GYNODIOECIOUS · GYNOMONOECIOUS (P)

SD098 seed[2] (*n.*) A small reproductive structure, the product of a fertilized ovule; it contains an embryo ready for germination, is enclosed by a protective coat, and is provided with a food reserve. The life-cycle of a spermatophyte has evolved from simpler alternation of generations, as in the fern. The flowering plant is the sporophyte generation and the gametophyte generation is much reduced. Ovules have evolved from megasporangia and anthers from microsporangia. The female gametophyte remains on the sporophyte and is protected by and nourished in the ovule. The male gametophyte consists of the germinated pollen grain and its pollen tube. The male gamete is non-motile. Fertilization by means of a pollen tube avoids the necessity of water for the union of the gametes, thus allowing sexual reproduction in a greater variety of drier environments. The embryo is protected and nourished by a store of food during the initial period of its growth until an independent individual plant is established. Seeds can be distinguished from fruits in that seeds have only one scar where the ovule stalk was attached, while fruits have two scars, one from the flower stalk attachment and the other from style or stigma attachments □ *seeds germinate to form seedlings* —SEEDLING (*n.*) ***seeded*** (*adj.*) SEED (*v.*) ↓ TESTA[1] · COTYLEDON · RIPEN · MONOCOTYLEDONOUS · POLYSPERMOUS ↑ ALTERNATION OF GENERATIONS → EMBRYO[1]

SD099 testa[1] (*n., pl.* **testae**) The external coat of a seed, formed from the integument or integuments of the ovule; it protects the embryo and is hard and dry. ↓ TEGMEN[1] · HILUM[1] · CARUNCLE · ARIL · ARILLODE ↑ SEED[2] → INTEGUMENT[2]

SD100 tegmen[1] (*n.,pl.* **tegmina**) The thinner, inner coat of a seed; it is not always present. ↑ TESTA[1]

SD101 hilum[1] (*n.*) The scar on a seed left when the attached funicle is broken off. ↑ TESTA[1] → FUNICLE

SD102 caruncle (*n.*) (On a few seeds of flowering plants) a spongy outgrowth from the testa; it covers or hides the micropyle, *e.g.* as in a castor-oil seed. ↑ TESTA[1] → MICROPYLE

SD103 aril (*n.*) (In certain seeds) an additional outer integument or cover formed from the funicle after fertilization, *e.g.* as in the seeds of the yew tree. —***arillary, arillate*** (*adj.*) ARILLODE (*n.*) ↑ TESTA[1]

SD104 arillode (*n.*) A false aril, formed by development from the micropyle. ↑ TESTA[1] → MICROPYLE

SD105 cotyledon (*n.*) A simple leaf, part of the embryo of a spermatophyte. It is either a food-storage organ for the embryo, or it absorbs food from the endosperm of the seed to provide nourishment for the embryo. Gymnosperms have 3 to 12 cotyledons. Angiosperms are divided into two divisions, those with one cotyledon (monocotyledons) and those with two cotyledons (dicotyledons). Cotyledons do not possess chlorophyll when in the seed; those cotyledons which appear above ground produce chlorophyll. —***monocotyledon, dicotyledon*** (*n.*) ***cotyledonous*** (*adj.*) ↓ SCUTELLUM · ENDOSPERM[1] · ENDOSPERM[2] · PERISPERM · SEED-LEAF (Sn) · MONOCOTYLEDONOUS ↑ SEED[2] → EPIGEAL[1] · MONOCOTYLEDON · DICOTYLEDON

SD106 scutellum (*n.*) **1** A development of part of the cotyledon in the seeds of grasses; it separates the embryo from the endosperm. **2** The term is also used for the large cotyledon in maize seeds. ↑ COTYLEDON

SD107 endosperm[1] (*n.*) A nutritive tissue formed in the embryo sac of angiosperms by the rapid division of the endosperm nucleus. It is a food reserve for the embryo. In non-endospermous seeds, the endosperm is absorbed into the cotyledons; in endospermous seeds, the endosperm persists as part of the seed and provides a store of food for the seedling. —ENDOSPERMOUS, NON-ENDOSPERMOUS, EXENDOSPERMOUS (*adj.*) ↓ ENDOSPERMOUS ↑ COTYLEDON

SD108 endosperm[2] (*n.*) The tissue of the female gametophyte (prothallus) in the ovule of gymnosperms; it nourishes the young embryo and disappears before the seed is dispersed. ↑ COTYLEDON

SD109 perisperm (*n.*) (In some seeds) a nutritional tissue surrounding the embryo; the tissue is derived from the nucellus of the OVULE. —***perispermous, non-perispermous*** (*adj.*) ↑ COTYLEDON → NUCELLUS

SD110 seed-leaf (*n.*) Alternative elementary term for COTYLEDON (↑).

SD111 ripen (*v.i.*) (Of seeds and fruits) to develop and become ready for the reproduction of the next generation, *e.g.* edible fruits have ripened when they are ready to be eaten by animals for the purpose of seed dispersion. —***ripeness*** (*n.*) ***ripe*** (*adj.*) ↑ SEED[2] → MATURE[1] (Sn)

SD112 monocotyledonous (*adj.*) Describes a seed possessing only one cotyledon, belonging to the class Monocotyledoneae. All angiosperms have seeds which are either monocotyledonous or dicotyledonous, and endospermous or non-endospermous. ↓ DICOTYLEDONOUS · ENDOSPERMOUS · NON-ENDOSPERMOUS · EXENDOSPERMOUS ↑ SEED[2]

SD113 dicotyledonous (*adj.*) Describes a seed possessing two cotyledons; it can be either endospermous or non-endospermous. ↑ MONOCOTYLEDONOUS

SD114 endospermous (*adj.*) Describes a seed possessing an endosperm; the seed can be either monocotyledonous or dicotyledonous. ↑ ENDOSPERM[1] · MONOCOTYLEDONOUS

SD115 non-endospermous (*adj.*) Describes a seed with food stored in cotyledons only and not possessing an endosperm; common amongst dicotyledonous plants but very rare amongst monocotyledonous plants. ↑ MONOCOTYLEDONOUS

SD116 exendospermous (*adj.*) Alternative term for NON-ENDOSPERMOUS.

SD117 polyspermous (*adj.*) (Of plants) having many seeds. ↑ SEED[2]

Genital Organs

SE001 genital organs (*n.pl.*) (In animals) the gonads and associated structures for coition and for the development of embryos or fertilized ova. ↓ URINOGENITAL DUCT · SEMINAL VESICLE · CLITELLUM · GENITALIA · OVIPOSITION · OVIPOSIT · PENIS · UTERUS · MAMMA → REPRODUCTION · GONAD · COITION

SE002 urinogenital duct (*n.*) A duct leading from the kidney to the cloaca in amphibians; it conducts spermatozoa from the vasa efferentia, and urine from the kidney, to the cloaca. There are two such ducts in a male amphibian. ↓ URINOGENITAL SINUS · URINOGENITAL PAPILLA · WOLFFIAN DUCT · GONODUCT ↑ GENITAL ORGANS

SE003 urinogenital sinus (*n.*) (In fishes) a small chamber into which the vas deferens delivers spermatozoa and the ureters deliver urine. There are two such sinuses in a male fish, and they open into the cloaca. ↑ URINOGENITAL DUCT → SINUS

SE004 urinogenital papilla (*n.*,*pl.* **urinogenital papillae**) A small conical projection in the cloaca of some vertebrates; a small aperture in the papilla provides an opening for either a urinogenital duct or a urinogenital sinus. ↑ URINOGENITAL DUCT

SE005 Wolffian duct (*n.*) (In vertebrate embryos) a duct from the pronephros. In adult amniotes it becomes the mesonephric duct; in some male amniotes it develops into the urinogenital duct and both urine and spermatozoa are discharged through it, in which case seminal vesicles are attached to its side. In other male amniotes it forms the epididymis and the vas deferens. In the female it degenerates. In anamniotes, it forms the kidney duct of the adult. There

are two Wolffian ducts, one on each side of the body. ↑ URINOGENITAL DUCT

SE006 gonoduct (*n.*) A duct leading from a gonad to the exterior. ↑ URINOGENITAL DUCT

SE007 seminal vesicle (*n.*) A sac in a male or hermaphrodite animal; it stores spermatozoa. In higher vertebrates it does not store spermatozoa, but produces a secretion for the seminal fluid. ↓ SPERMATHECA (Sn) · OVIDUCT · OVISAC · OVIDUCAL GLAND ↑ GENITAL ORGANS

SE008 spermatheca (*n.,pl.* **spermathecae**) (In invertebrates) a sac found in females or hermaphrodites for the storage of spermatozoa received from another individual (male or hermaphrodite). The spermatozoa are shed onto ova as the ova are laid. Queen bees and queen ants only mate once and store enough spermatozoa for several years. ↑ SEMINAL VESICLE

SE009 oviduct (*n.*) A tube conducting ova from the ovary to the uterus, or from the coelom, into which the ova are shed, to the exterior. —***oviducal*** (*adj.*) ↑ SEMINAL VESICLE

SE010 ovisac (*n.*) (In amphibians) a receptacle with thin membranous walls for retaining ova before they are discharged. It is the most posterior part of the oviduct and opens through a large orifice into the cloaca. ↑ SEMINAL VESICLE

SE011 oviducal gland (*n.*) (In elasmobranchs) a swollen part of the oviduct; spermatozoa are stored there and fertilize ova passing down the oviduct. The gland also secretes a horny shell around the fertilized ovum. ↑ SEMINAL VESICLE

SE012 clitellum (*n.*) A thickening of the body wall present in sexually mature members of some Annelida, such as earthworms and leeches. It contains glandular cells which secrete mucus and is used to form a sheath round copulating worms. The glandular cells also secrete a horny envelope during oviposition which develops into a cocoon round fertilized eggs. ↓ OVIPOSITOR · CLASPER ↑ GENITAL ORGANS

SE013 ovipositor (*n.*) (In insects) a tube-like structure, sometimes with a sharp point, used to place eggs in a suitable position, *e.g.* in holes in the ground, in trees, or under the skin of animals. ↑ CLITELLUM

SE014 clasper (*n.*) **1** (In male elasmobranchs) one of two rod-like processes borne on the pelvic fin, used to grip the female during copulation. **2** Any similar structure on an insect or other invertebrate, used for the same function. ↑ CLITELLUM

SE015 genitalia (*n., pl.*) Alternative term for GENITAL ORGANS (↑).

SE016 genitals (*n., pl.*) The external sex organs of animals. ↑ GENITALIA

SE017 oviposition (*n.*) The action of ovipositing. ↑ GENITAL ORGANS

SE018 oviposit (*v.i.*) (Of invertebrates) to lay eggs. —OVIPOSITOR. OVIPOSITION (*n.*) ↑ GENITAL ORGANS

SE019 penis (*n.*) The male copulatory organ for introducing spermatozoa into a female; it contains spongy vascular tissue which can become engorged with blood, causing the erection of the organ. ↓ PREPUCE · SEMINIFEROUS TUBULE · TUMESCENCE · ENGORGE · ERECTILE ↑ GENITAL ORGANS

SE020 prepuce (*n.*) (In mammals) the loose fold of skin covering the penis. ↓ VAS DEFERENS · EPIDIDYMIS ↑ PENIS

SE021 vas deferens (*n., pl.* **vasa deferentia**) A tube conducting spermatozoa from the testis to the exterior. In amniotes it conducts spermatozoa from the epididymis to the cloaca or urethra. There is one such tube on each side of the body. ↑ PREPUCE

SE022 epididymis (*n.*) (In amniotes) a long, convoluted tube which receives spermatozoa from the vas efferens and conducts them to the vas deferens. There is one such tube on each side of the body. ↑ PREPUCE

SE023 seminiferous tubule (*n.*) A long, coiled tube made of germinal epithelium; in it the stages of spermatogenesis take place, the tubule being nutritive. It corresponds to the ovarian follicle of a female. The testes of a vertebrate consist of many seminiferous tubules. ↓ VAS EFFERENS · SPERMATIC CORD · SCROTAL SACS · SCROTUM · GUBERNACULUM · INGUINAL CANAL · PROSTATE GLAND ↑ PENIS → OVARIAN FOLLICLE

SE024 vas efferens (*n., pl.* **vasa efferentia**) (In vertebrates) a tube conducting spermatozoa from a testis to a urinogenital duct or an epididymis. There are many such tubes leading off from a testis. ↑ SEMINIFEROUS TUBULE

SE025 spermatic cord (*n.*) A thin strip of connective tissue containing the spermatic artery, spermatic vein and spermatic nerve. It leads from the abdomen of a mammal to the testes. ↑ SEMINIFEROUS TUBULE

SE026 scrotal sacs (*n., pl.*) (In most mammals) a pair of pouches in the pelvic region, containing the testes; their function is the same as that of a ***scrotum***. ↑ SEMINIFEROUS TUBULE

SE027 scrotum (*n.*) (In some mammals) a pouch of skin in the pelvic region. It contains the testes and keeps them below body temperature, since the higher body temperature inhibits spermatogenesis. ↑ SEMINIFEROUS TUBULE

SE028 gubernaculum (*n.*) A strip of connective tissue by which the testes and epididymis are attached to the scrotal sacs. ↑ SEMINIFEROUS TUBULE

SE029 inguinal canal (*n.*) A passage connecting the abdomen to the scrotal sacs. The testes descend down the inguinal canal at puberty in some mammals and during the rutting season in other mammals. If the testes do not descend at the correct time, the animal is called a ***rig***; it cannot mate with a female, although it possesses all other male characteristics. ↑ SEMINIFEROUS TUBULE

SE030 prostate gland (*n.*) (In mammals) a gland forming part of the male reproductive system, it contributes a secretion to semen but its function is unknown. The size of the gland and the quantity of secretion are

controlled by androgens. ↑ SEMINIFEROUS TUBULE

SE031 tumescence (*n.*) The disposition to swell or the condition of swelling in tissues. The swelling can result from infection or by engorgement with blood. —***tumescent*** (*adj.*) ↓ DETUMESCENCE (Cn) ↑ PENIS

SE032 detumescence (*n.*) The return to normal of a tissue after tumescence. ↑ TUMESCENCE (Cn)

SE033 engorge (*v.t.*) To overfill vessels or spaces in tissues with blood, *e.g.* tumescence can be caused by tissues being engorged. —***engorgement*** (*n.*) ↑ PENIS

SE034 erectile (*adj.*) Able to become hard by the forcing of blood into spongy vascular tissue. —***erection*** (*n.*) ***erected*** (*adj.*) ↑ PENIS

SE035 uterus (*n., pl.* **uteri**) **1** (In female mammals, except monotremes) an organ in which the embryo develops and is nourished; it has walls of unstriated muscle which increase greatly in thickness during pregnancy and whose contractions expel the embryo at birth. The uterus is lined with endometrium which undergoes modification during pregnancy and is also modified under control of sex hormones during the oestrus cycle. The uterus is connected through the cervix to the vagina. In most mammals there are two uteri with a common cervix; in human beings there is only one uterus. **2** (In ovoviviparous vertebrates) an expansion, branch, or the lower part, of an oviduct in which eggs develop and young are hatched before birth. —UTERINE (*adj.*) ↓ VAGINA[2] · OSTIUM[3] · UTERINE ↑ GENITAL ORGANS

SE036 vagina[2] (*n., pl.* **vaginae**) (In female mammals, except monotremes) a canal connecting the uterus with the vestibule; the entrance to the uterus is through the cervix and the entrance to the vestibule is through the vaginal orifice. It is lined with stratified non-glandular epithelium. In many mammals, cyclical changes take place in the vaginal wall in rhythm with the oestrous cycle. Its functions are to receive the penis and to act as a birth canal for offspring. —VAGINAL (*adj.*) ↓ LABIA · VESTIBULE[2] · HYMEN · CLITORIS · CERVIX[2] · VULVA · WOMB · FALLOPIAN TUBE ↑ UTERUS

SE037 labia (*n., pl.*) (In human beings) the lips enlosing the orifice of the vagina and the orifice of the urethra; there are two pairs of labia: **labia majora**, the outer lips, and **labia minora**, the inner lips. ↑ VAGINA[2]

SE038 vestibule[2] (*n.*) **1** (In mammals, except monotremes) a small chamber into which the urethra and the vagina open. **2** (In human beings) the cleft between the labia minora; in it are situated the orifices to the urethra and the vagina. Between the two orifices, numerous small mucous glands open into the vestibule. —***vestibular*** (*adj.*) ↑ VAGINA[2]

SE039 hymen (*n.*) A thin fold of mucous membrane situated at the vaginal orifice; it varies in size and shape. When it is small, the vaginal orifice is large, and vice versa. —***hymenal*** (*adj.*) ↑ VAGINA[2]

SE040 clitoris (*n.*) A small structure with a free extremity, situated at the anterior end of the labia minora; it consists of erectile tissue, is highly sensitive, and is homologous with the penis. ↑ VAGINA[2]

SE041 cervix[2] (*n.*) The narrow opening to the uterus, a short tube leading from the vagina to the uterus. —CERVICAL (*adj.*) ↑ VESTIBULE[2] → CERVIX[1]

SE042 vulva (*n.*) A general term used of female human beings; it includes the two pairs of labia, the clitoris and the vestibule, *i.e.* the external genital organs of a female. ↑ VAGINA[2]

SE043 womb (*n.*) Alternative term for UTERUS (↑).

SE044 fallopian tube (*n.*) (In female mammals) one of two ducts on each side of the uterus, about 12 cm in length in human beings, each with a funnel at the distal end and with the proximal end entering the uterus. The funnel is lined with fimbriae, is just beside an ovary, and opens into the peritoneal cavity. The tube conducts eggs by ciliary and muscular action from the ovary to the uterus; it conducts spermatozoa from the uterus to the distal portion of the tube, where fertilization usually takes place. ↑ VAGINA[2]

SE045 ostium[3] (*n., pl.* **ostia**) (In mammals) the opening at either end of the fallopian tubes. ↑ UTERUS → OSTIUM[1]

SE046 uterine (*adj.*) Of or to do with the uterus, *e.g.* ***a*** the uterine walls; ***b*** uterine contractions; ***c*** the uterine vein. ↓ VAGINAL ↑ UTERUS

SE047 vaginal (*adj.*) Of or to do with a vagina. ↑ UTERINE

SE048 mamma (*n., pl.* **mammae**) The milk-secreting organ of female mammals; it contains a mammary gland. —***mammal*** (*n.*) ***mammary*** (*adj.*) ↓ MAMMARY GLAND · MARSUPIUM ↑ GENITAL ORGANS

SE049 mammary gland (*n.*) A large gland on the ventral surface of mature female mammals; it is thought to be a modified sweat gland and is peculiar to mammals alone. It consists of clusters of gland cells that can extract the necessary substances from blood to produce milk. The milk drains through ducts into a cistern. A canal leads from the cistern to a mammary papilla. The growth and activity of the gland is under the control of gonadial hormones and the state of the gland is influenced by the oestrous cycle. Milk production is stimulated by the pituitary lactogenic hormone. ↓ UDDER · TEAT · NIPPLE · COLOSTRUM ↑ MAMMA

SE050 udder (*n.*) The mamma of a herbivorous animal, such as a cow, horse, or goat. ↑ MAMMARY GLAND

SE051 teat (*n.*) A mammary papilla on the surface at the end of a mamma. ↓ NIPPLE (Sn) ↑ MAMMARY GLAND

SE052 nipple (*n.*) Alternative term for TEAT (↑), especially in human beings. ↑ MAMMARY GLAND · TEAT (Sn)

SE053 colostrum (*n.*) (In mammals) maternal milk produced for the first few days after birth; the milk is particularly rich in protein and in some mammals includes antibodies. ↑ MAMMARY GLAND

SE054 marsupium (*n.,pl.* **marsupia**) (In many marsupials) a fold of skin, supported on epipubic bones, forming a pouch. Teats on the mother's abdomen supply the newborn offspring with milk when they are in the marsupium. **2** Any similar structure in invertebrate animals where eggs or offspring are kept. ↑ MAMMA

Flowers

SF001 flower (*n.*) (In angiosperms) an unlengthened, specialized, reproductive stem, whose leaves are modified as floral organs. The typical flower consists of ***accessory*** flower parts (the perianth and supporting structures) which are not directly concerned with reproduction, and ***essential*** flower parts (the carpels and stamens) which are the reproductive organs. There are four different kinds of organ on a flower, all or some of which are present in any one flower; they are sepals, petals, stamens and carpels □ *the plant bears flowers during the summer season; the flowers blossom in the spring; the plant is in flower for only a week; the flowers on the tree are in full bloom* —***flowerless*** (*adj.*) FLOWERING (*adj.*) FLOWER (*v.*) ↓ COMPLETE FLOWER · INCOMPLETE FLOWER · REGULAR FLOWER · IRREGULAR FLOWER · FLORET (H) · FLOWER STALK · BLOOM · FLOWERING · ACTINOMORPHIC · HYPOGYNOUS · PERIANTH · EPICALYX · INFLORESCENCE · GYNOECIUM · PLACENTA[2] · ANDROECIUM · FRUIT BODY · SEX ORGANS[2] → REPRODUCTION

SF002 complete flower (*n.*) A flower in which all four floral whorls are present. ↑ FLOWER

SF003 incomplete flower (*n.*) A flower in which one or more of the floral whorls is absent. ↑ FLOWER

SF004 regular flower (*n.*) A flower in which division along any longitudinal plane produces two identical halves, *i.e.* an actinomorphic flower. ↑ FLOWER

SF005 irregular flower (*n.*) A flower in which division into two identical halves (mirror images) can be made only along one longitudinal plane, *i.e.* a zygomorphic flower. ↑ FLOWER

SF006 floret (*n.*) A small, individual flower, which is part of a cluster of florets, as in a composite flower or a small flower, with lemma and palea, as in grasses. In composite flowers, each floret has its own essential flower parts, *i.e.* carpels and stamens, as well as its accessory flower parts. ↓ LIGULE[1] (H) · BLOSSOM ↑ FLOWER

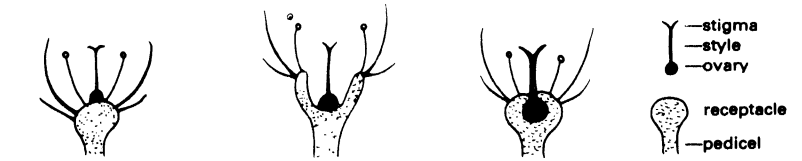
SF007 ligule[1] (*n.*) A tongue-shaped extension of the corolla of a floret, usually found in the outer florets in a composite flower. ↑ FLORET

SF008 blossom (*n.*) **1** A flower which is on the point of opening out, or has opened out, and is ready to be fertilized. **2** A flower or the flowers on a tree □ *the blossoms on a tree, i.e.* the individual flowers; *the blossom on a tree, i.e.* all the flowers on a tree; *to be in blossom; to come into blossom.* —BLOSSOM (*v.*) ↑ FLORET

SF009 flower stalk (*n.*) The thin stem or supporting structure of an individual flower or of an inflorescence. ↓ PEDICEL (H) · PEDUNCLE (Sn) · RECEPTACLE[1] · THALAMUS[2] · TORUS · WHORL[1] · SCAPE · RACHIS[1] ↑ FLOWER → PETIOLE

SF010 pedicel (*n.*) The stalk of an individual flower or of an inflorescence. ↑ FLOWER STALK → INFLORESCENCE

SF011 peduncle (*n.*) The stalk of an inflorescence. Also called ***pedicel.*** ↑ FLOWER STALK



DIAGRAMMATIC REPRESENTATION
TYPES OF FLORAL RECEPTACLE

SF012 receptacle[1] (*n.*) The apex of the flower-stalk; it bears the four groups of floral organs. Its shape varies from conical to concave and it is the axis of the flower. The gynoecium can be superior or inferior to the receptacle. A superior gynoecium is borne at the apex of a conical receptacle or at the centre of a concave receptacle. An

inferior gynoecium is borne inside the receptacle with the receptacle completely enclosing it; the carpel walls are fused with the wall of the receptacle. ↑ FLOWER STALK

SF013 thalamus[2] (*n.*) Alternative term for RECEPTACLE (↑).

SF014 torus (*n.*) Alternative term for RECEPTACLE. ↑ FLOWER STALK

SF015 whorl[1] (*n.*) A circle of leaves or floral organs, all arising from a stem at one level. ↑ FLOWER STALK

SF016 scape (*n.*) A leafless flower stalk arising at or under the ground level; it usually bears a composite flower and has a ring of leaves around its base. ↑ FLOWER STALK

SF017 rachis[1] (*n.*) The main axis of an inflorescence. ↑ FLOWER STALK → INFLORESCENCE

SF018 bloom (*v.i.*) (Of a flower) to be at maturity, ready to be fertilized. —BLOOM (*n.*) ↑ FLOWER

SF019 flowering (*adj.*) (Of a plant) bearing flowers or having the disposition to bear flowers, *i.e.* having the characteristics of an angiosperm. ↓ FLORAL · MONANTHOUS · TRIANTHOUS · POLYANTHOUS ↑ FLOWER → ANGIOSPERMAE

SF020 floral (*adj.*) Of or to do with flowers, *e.g.* a petal is a floral leaf. ↑ FLOWERING

SF021 monanthous (*adj.*) Describes a plant bearing only one flower. ↑ FLOWERING

SF022 trianthous (*adj.*) Describes a plant bearing three flowers. ↑ FLOWERING

SF023 polyanthous (*adj.*) Describes a plant bearing many flowers. ↑ FLOWERING

SF024 actinomorphic (*adj.*) Possessing radial symmetry; regular in shape, *e.g.* (of flowers) able to be bisected vertically by any number of planes to form two identical halves. —***actinomorphism*** (*n.*) ↓ ZYGOMORPHIC (An) · TRIMEROUS · PENTAMEROUS · PAPILIONACEOUS ↑ FLOWER

SF025 zygomorphic (*adj.*) Possessing only one plane of symmetry, *e.g.* when a flower, such as the pea flower, is bisected along the plane of symmetry, one half is the mirror-image of the other half. —***zygomorphism*** (*n.*) ↑ ACTINOMORPHIC

SF026 trimerous (*adj.*) Describes a flower with floral organs in whorls of three or multiples of three, *e.g.* many monocotyledonous flowers are trimerous, with six perianth segments. ↑ ACTINOMORPHIC

SF027 pentamerous (*adj.*) Describes a flower with floral organs in whorls of five or multiples of five, *e.g.* many dicotyledonous flowers are pentamerous, possessing five petals, five sepals, etc. ↓ PAPILIONACEOUS (H) ↑ ACTINOMORPHIC

SF028 papilionaceous (*adj.*) Describes a corolla consisting of five petals: one standard, two wings, and two united to form a keel, *e.g.* the flowers of legumes. ↑ ACTINOMORPHIC → STANDARD[3] · KEEL[2]

SF029 hypogynous (*adj.*) Describes a flower in which the sepals, petals, and stamens, are borne on the receptacle at a point below the carpels, *i.e.* a flower with a superior gynoecium (see diagram at **receptacle**). —***hypogyny*** (*n.*) ↓ PERIGYNOUS · EPIGYNOUS ↑ FLOWER

SF030 perigynous (*adj.*) Describes a flower in which the sepals, petals, and stamens, are borne on the margin of a concave receptacle with the carpels of a superior ovary at the centre of the receptacle, *i.e.* the other floral parts are at a level around the gynoecium. —***perigyny*** (*n.*) ↑ HYPOGYNOUS

SF031 epigynous (*adj.*) Describes a flower in which the sepals, petals, and stamens, are borne on the apex of the receptacle with the receptacle completely enclosing and fused with an inferior ovary, *i.e.* the other floral parts are borne at a point above the gynoecium. —***epigyny*** (*n.*) ↑ HYPOGYNOUS

SF032 monoclinous (*adj.*) Describes a flower possessing both male and female reproductive organs, *i.e.* stamens and pistils. ↑ HYPOGYNOUS

SF033 diclinous (*adj.*) Alternative term for MONOECIOUS (→), *i.e.* with stamens and pistils on separate flowers. ↑ HYPOGYNOUS

SF034 perianth (*n.*) The outer, non-sexual group of leaf-like segments of a flower; it encloses the stamens and pistil. The perianth constitutes the accessory parts of a flower. In monocotyledons all the perianth segments are similar. In dicotyledons the segments are differentiated into an outer whorl, the calyx, and an inner whorl, the corolla. ↓ CALYX (H) · COROLLA (H) · NECTAR · MONOCHLAMYDEOUS · PETALOID · POLYSEPALOUS ↑ FLOWER

SF035 calyx (*n.,pl.* **calyces**) The outermost whorl of leaf-like segments (called **sepals**) of a dicotyledonous flower; the segments are usually green, and enclose and protect the flower in the bud stage. —***calycoid*** (*adj.*) ↓ SEPAL · TEPAL ↑ PERIANTH

SF036 sepal (*n.*) One segment of the whorl of segments in a calyx. —***sepalody*** (*n.*) ***sepalous, sepaloid, sepaled*** (*adj.*) ↑ CALYX

SF037 tepal (*n.*) A perianth segment where there is no distinction between sepals and petals, *e.g.* as in the tulip. ↑ CALYX

SF038 corolla (*n.*) The whorl of coloured, leaf-like segments (called **petals**) inside the calyx of a dicotyledonous flower. It is usually the most conspicuous part of the flower. —COROLLACEOUS (*adj.*) ↓ PETAL · COROLLA TUBE · KEEL[2] · STANDARD[3] · WING-PETAL · SPUR[2] · PETALIFEROUS ↑ PERIANTH

SF039 petal (*n.*) One segment of the whorl of segments in a corolla. The shape and colour of the petals of a particular flower, and their arrangement, are suited to the method of pollination of the flower. Petals can be free or united to form a tube □ *the petals of a flower unfold when the flower matures* —PETALIFEROUS, PETALOIDEOUS, PETALOID (*adj.*) ↑ COROLLA

SF040 corolla tube (*n.*) (In some flowers) a tube formed by the uniting of lower parts of the petals. ↑ COROLLA

SF041 keel[2] (*n.*) A sac-shaped lower petal or a sac formed from two united lower petals, found in some insect-pollinated

zygomorphic flowers. The flowers of legumes have a keel. ↑ COROLLA

SF042 standard[3] (*n.*) A large, brightly-coloured, upright petal above the keel of a zygomorphic flower, such as a legume. ↑ COROLLA

SF043 wing-petal (*n.*) One of two side petals between the keel and the standard of a zygomorphic flower, such as a legume. ↑ COROLLA

SF044 spur[2] (*n.*) A slender hollow projection of a petal; it sometimes contains a nectary. ↑ COROLLA

SF045 nectar (*n.*) A fluid containing sugar, secreted by the nectaries of a flower. Sucrose is the commonest sugar contained in nectar, with fructose and glucose next most common. The fluid attracts insects to flowers. —NECTARY (*n.*) NECTARIFEROUS, NECTARIVOROUS (*adj.*) ↓ NECTARY · FLORAL LEAF ↑ PERIANTH

SF046 nectary (*n.*) A gland secreting nectar, found in many flowers and in certain leaves, particularly of those plants which are insect-pollinated. The nectary is situated in a flower in such a position that an insect sucking nectar brushes against the stamens and stigmas and causes cross-pollination by visiting various flowers. ↑ NECTAR → CROSS-POLLINATION

SF047 floral leaf (*n.*) A bract, sepal, or petal. ↑ NECTAR

SF048 monochlamydeous (*adj.*) (Of flowers) possessing only one whorl of segments in the perianth, *e.g.* many monocotyledons are monochlamydeous. ↓ HAPLOCHLAMYDEOUS · DICHLAMYDEOUS · ACHLAMYDEOUS · COROLLACEOUS · COROLLIFEROUS · HOMOCHLAMYDEOUS · NECTARIFEROUS · HETEROCHLAMYDEOUS ↑ PERIANTH

SF049 haplochlamydeous Alternative term for MONOCHLAMYDEOUS (↑).

SF050 dichlamydeous (*adj.*) (Of flowers) possessing two whorls of segments in the perianth, *e.g.* dicotyledons are dichlamydeous. ↑ MONOCHLAMYDEOUS

SF051 achlamydeous (*adj.*) Describes a flower lacking petals and sepals. ↑ MONOCHLAMYDEOUS

SF052 corollaceous (*adj.*) Of or to do with a corolla. ↑ MONOCHLAMYDEOUS

SF053 corolliferous (*adj.*) (Of flowers) having a corolla. ↑ MONOCHLAMYDEOUS

SF054 homochlamydeous (*adj.*) (Of flowers) having two whorls of similar perianth segments, *i.e.* having tepals. ↑ MONOCHLAMYDEOUS

SF055 nectariferous (*adj.*) (Of plants) secreting nectar or having nectaries. ↑ MONOCHLAMYDEOUS

SF056 heterochlamydeous (*adj.*) (Of flowers) having two distinct whorls of perianth segments, *i.e.* possessing both sepals and petals. ↑ MONOCHLAMYDEOUS

SF057 petaloid (*adj.*) Resembling a petal; used to describe the segments of the perianth of some monocotyledons. ↓ PETALOIDEOUS · PETALIFEROUS · APETALOUS · POLYPETALOUS · GAMOPETALOUS · SYMPETALOUS · MONOPETALOUS ↑ PERIANTH · PETAL

SF058 petaloideous (*adj.*) Describes a monocotyledonous flower with a perianth of coloured segments resembling petals. ↑ PETALOID

SF059 petaliferous (*adj.*) Describes a dicotyledonous flower bearing petals. ↑ PETALOID

SF060 apetalous (*adj.*) Describes a flower without petals. ↑ PETALOID · PETALIFEROUS (An)

SF061 polypetalous (*adj.*) Describes a flower or a corolla with its petals free or separate from one another. ↓ GAMOPETALOUS (An) ↑ PETALOID

SF062 gamopetalous (*adj.*) Describes a flower or a corolla with its petals united to each other. ↑ PETALOID · POLYPETALOUS (An)

SF063 sympetalous (*adj.*) Alternative term for GAMOPETALOUS (↑).

SF064 monopetalous (*adj.*) Describes a flower with only one petal, or having its petals united, *i.e.* gamopetalous. ↑ PETALOID

SF065 polysepalous (*adj.*) Describes a flower or a calyx having its sepals free and separate from one another. ↓ GAMOSEPALOUS (An) · SYNSEPALOUS · MONOSEPALOUS ↑ PERIANTH · SEPAL

SF066 gamosepalous (*adj.*) Describes a flower or calyx with its sepals united or fused. ↑ POLYSEPALOUS (An)

SF067 synsepalous (*adj.*) Alternative term for GAMOSEPALOUS. ↑ POLYSEPALOUS

SF068 monosepalous (*adj.*) Describes a flower with only one sepal, or having all its sepals united, *i.e.* gamosepalous. ↑ POLYSEPALOUS

SF069 epicalyx (*n.*) (In some flowers) a whorl of bracts or bracteoles outside the calyx. ↓ CALYCLE · BRACT · SPIKELET · BRACTEAL · AWNED ↑ FLOWER

SF070 calycle (*n.*) Alternative term for EPICALYX (↑). ↓ CALYCULUS

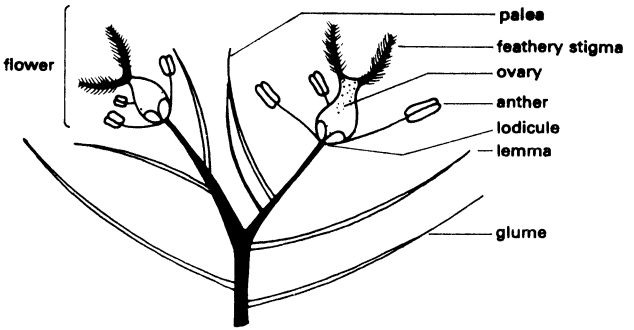
SF071 calyculus (*n.*) Alternative term for EPICALYX (↑).

SF072 bract (*n.*) A small leaf, usually green and of simple structure; the stalk of a flower or of an inflorescence arises in the axil of a bract. —BRACTEOLE (*n.*) BRACTEAL, BRACTEATE, BRACTEOSE (*adj.*) ↓ BRACTEOLE (H) · SPATHE · INVOLUCRE ↑ EPICALYX

SF073 bracteole (*n.*) A small bract on a flower stalk; a secondary bract at the base of an individual flower of an inflorescence. —BRACTEOLATE (*adj.*) ↓ BRACTEOLATE ↑ BRACT

SF074 spathe (*n.*) A large bract protecting a spadix (an inflorescence) or protecting the unopened flower of some monocotyledons, *e.g.* the daffodil, polyanthus. ↑ BRACT → SPADIX

SF075 involucre (*n.*) **1** A protective covering consisting of bracts forming a whorl at the base of a capitulum or an umbel; the involucre protects the young inflorescence. **2** (In mosses) a group of leaves surrounding the archegonia and antheridia. ↑ BRACT



GRASS SPIKELET

→ CAPITULUM[2] · UMBEL · ARCHEGONIUM · ANTHERIDIUM

SF076 spikelet (*n.*) A small spike (inflorescence), particularly the inflorescence of a grass; one or more flowers are enclosed in green scales, called **glumes.** ↓ GLUME · LEMMA · PALEA · LODICULES · AWN · ARISTA ↑ EPICALYX

SF077 glume (*n.*) A small scale-like bract; a pair of glumes enclose a grass spikelet. —***glumiferous*** (*adj.*) ↑ SPIKELET

SF078 lemma (*n., pl.* **lemmae**) A small bract inferior to a grass flower; the flower arises in the axil of the lemma. ↑ SPIKELET

SF079 palea (*n., pl.* **paleae**) (In grasses) a small bract in the axis of the flower stalk and superior to the flower; the palea and lemma together enclose the young flower. ↑ SPIKELET

SF080 lodicules (*n., pl.*) Two tiny, scale-like structures below the ovary of a grass-flower; they represent a much reduced perianth. When the flower is mature, the lodicules swell up, forcing apart the palea and the lemma and exposing the stamens and stigmas. ↑ SPIKELET · PERIANTH

SF081 awn (*n.*) A slender, stiff, bristle-like process on the apex of a glume; found on many grasses. —AWNED (*adj.*) ↑ SPIKELET

SF082 arista (*n.*) Alternative term for AWN (↑). —ARISTATE, ARISTULATE (*adj.*)

SF083 bracteal (*adj.*) Of or to do with bracts. ↓ BRACTEATE · BRACTEOSE · BRACTEOLATE ↑ EPICALYX · BRACT

SF084 bracteate (*adj.*) Describes a flower or a plant having bracts. ↑ BRACTEAL

SF085 bracteose (*adj.*) Describes a flower or a plant having many bracts. ↑ BRACTEAL

SF086 bracteolate (*adj.*) Describes a flower having bracteoles. ↑ BRACTEAL

SF087 awned (*adj.*) Describes a glume of grasses which bears an awn. ↓ ARISTATE · ARISTULATE ↑ EPICALYX

SF088 aristate (*adj.*) Bearing awns or having well-developed bristles. ↑ AWNED (Sn)

SF089 aristulate (*adj.*) Having a short awn or a short bristle on a glume. ↑ AWNED

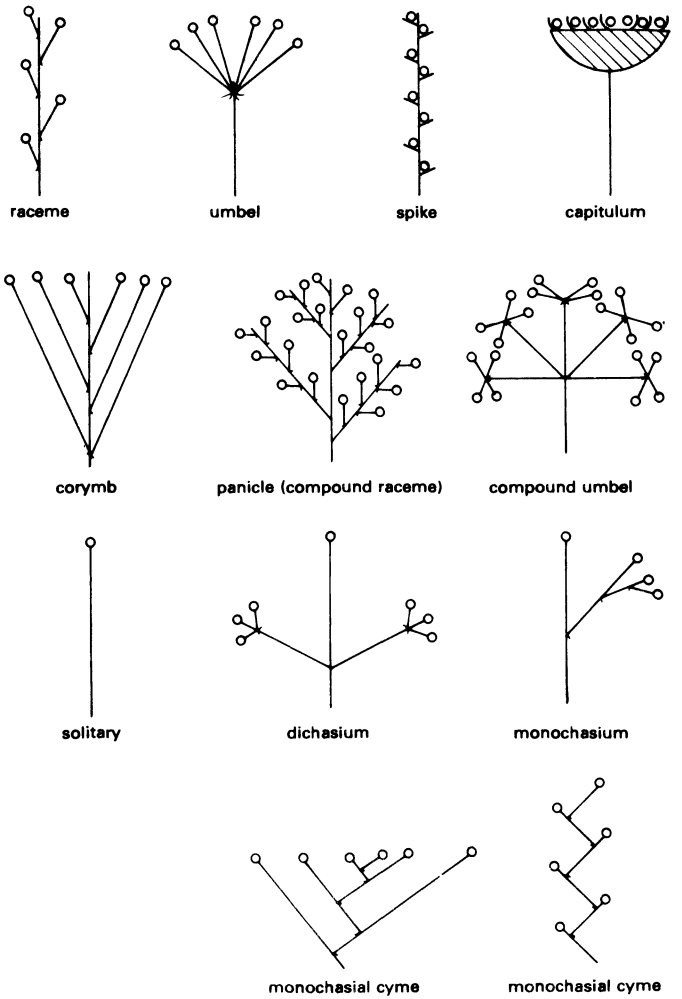
SF090 inflorescence (*n.*) **1** A flowering shoot. **2** The arrangement of flowers on an axis. The flower is rarely borne singly; usually flowers are clustered into groups about a central axis. The arrangement is described in terms of the branching of the flowering shoot and the growth of the axis. The two basic arrangements are called **racemose inflorescences** (or indefinite inflorescences) and **cymose inflorescences** (or definite inflorescences). Many inflorescences are mixed, *e.g.* a raceme of cymes, or are compound, *e.g.* an umbel of umbels. A single flower on an axis is called a solitary flower. In racemose inflorescences the flowers open from the bottom of the shoot upwards or from the outside of the cluster inwards, *i.e.* an acropetal development. In cymes the oldest flowers are at the top. (See diagram on opposite page.) ↓ RACEME · CYME · COMPOUND UMBEL · CAULIFLORY · FLORAL FORMULA · RACEMOSE · ISOMEROUS

SF091 raceme (*n.*) An inflorescence in which the main axis bears stalked flowers arising singly from the axis. The axis increases in length, giving rise to lateral flower-stalks, by growing at the top. No flower is formed at the top of the axis so the growth is never considered to be ended, *i.e.* it is an indefinite inflorescence. The lateral shoots arise alternately on each side of the axis ☐ *the inflorescence is a raceme; the groups of flowers are in the form of a raceme; a racemose inflorescence* —RACEMOSE (*adj.*) ↓ PANICLE · CORYMB (H) · SPIKE (H) · SPADIX · CATKIN · UMBEL (H) · CAPITULUM[2] (H) · RACEMOSE ↑ INFLORESCENCE

SF092 panicle (*n.*) A compound raceme, *i.e.* the axis branches as a raceme and each branch is a raceme, *e.g.* the inflorescence of oats ☐ *the inflorescence is a panicle; a paniculate inflorescence* —***paniculate*** (*adj.*) ↑ RACEME

SF093 corymb (*n.*) A racemose inflorescence in which the pedicels (flower stalks) are of different lengths so that the flowers are borne at the same level, forming a flat-topped cluster ☐ *the corymb system of inflorescence is found in candytuft* ↑ RACEME

SF094 spike (*n.*) A racemose inflorescence in which the flowers are sessile, *i.e.* they do not have stalks ☐ *the form of inflorescence is an unbranched spike* ↓ SPADIX (H) · CATKIN (H) ↑ RACEME · SPIKELET



TYPES OF INFLORESCENCE

SF095 spadix (*n.*) A thick, succulent spike enclosed in a spathe. —***spadicose*** (*adj.*) ↑ RACEME

SF096 catkin (*n.*) A spike of unisexual, simple flowers, often with a pendulous axis. ↑ RACEME

SF097 umbel (*n.*) A racemose inflorescence in which the axis does not lengthen, so that the flower-stalks arise at the same point and the flowers are arranged in an umbrella-shaped cluster □ *the inflorescence of a carrot is an umbel; the carrot is umbelliferous; the carrot has an umbellate inflorescence; the carrot is an umbellifer* —***umbellifer,*** UMBELLULE (*n.*) ***umbellate, umbelliferous*** (*adj.*) ↑ RACEME

SF098 capitulum[2] (*n.*) A racemose inflorescence in which the main axis is laterally expanded and flattened; from it arise close-packed, sessile florets. This forms a composite flower, such as the daisy, in which the oldest florets are at the margin and the youngest are at the centre. The main axis is a scape. ↑ RACEME

SF099 cyme (*n.*) The main axis of this type of inflorescence ends in a flower. This forms a definite inflorescence, as growth of the axis ceases at the flower. The axis can branch in two ways; a single lateral branch can arise or a pair of lateral branches can arise at the same level. A single lateral branch forms a monochasial cyme (or

monochasium); and two lateral branches form a dichasial cyme (or **dichasium**). —CYMOSE (*adj.*) ↓ MONOCHASIUM (H) · DICHASIUM (H) · GLOMERULE (H) ↑ INFLORESCENCE

SF100 monochasium (*n., pl.* **monochasia**) A cyme with one lateral branch from an axis. The branching can be repeated and the pedicels can vary in length, giving rise to various shapes of inflorescences □ *the inflorescence of an iris is a monochasium; the inflorescence of an iris is a monochasial cyme* —MONOCHASIAL (*adj.*) ↑ CYME

SF101 dichasium (*n., pl.* **dichasia**) A cyme with two lateral branches arising at the same level; the pedicels can also produce two lateral branches. —DICHASIAL (*adj.*) ↑ CYME

SF102 glomerule (*n.*) **1** A condensed cyme of flowers; the flowers are practically sessile. **2** A compact cluster of spores. —GLOMERULAR, GLOMERULATE (*adj.*) ↑ CYME

SF103 compound umbel (*n.*) An umbel of umbels with each flower stalk forming an umbel at its end. ↓ UMBELLULE ↑ INFLORESCENCE

SF104 umbellule (*n.*) A small, or secondary umbel in an inflorescence which is a compound umbel. ↑ COMPOUND UMBEL

SF105 cauliflory (*n.*) The condition in which flowers arise from axillary buds on the main stem of a plant or the trunk of a tree, instead of on young twigs, *e.g.* the calabash and cocoa trees; this is very rare in non-tropical areas. ↑ INFLORESCENCE

SF106 floral formula (*n.*) A method of expressing the number and arrangements of the four whorls of a flower, using the letters K, C, P, A, G, and a number.

K stands for **calyx** and the number of sepals is shown after it, *e.g.* K5; if the sepals are united the figure is in brackets, *e.g.* K(5); if the sepals are free, no brackets are used.

C stands for **corolla** and the number of petals is shown; if the petals are united, the figure is in brackets, *e.g.* C(5); C5 shows a polypetalous flower.

P stands for **perianth** when undifferentiated into calyx and corolla; the number of segments is shown, free or united. If there are two whorls, the numbers are shown separately, *e.g.* P (3 + 3). The + sign indicates the whorls are undifferentiated, the bracket shows the segments are united.

A stands for **androecium**; the number of stamens is indicated by a figure and brackets show the stamens are united. If there are numerous stamens the sign ∞ is used, *e.g.* A(∞) indicates numerous united stamens, as in *Hibiscus*. If there are two types of stamens, they are shown by separate numbers, *e.g.* A(5 + 5) as in leguminous flowers.

G stands for **gynoecium**; the number of carpels is indicated by a figure, without brackets for apocarpous ovaries, with brackets for syncarpous ovaries. If the ovary is superior, a line is put under the figure, *e.g.* G(5) indicates five united carpels in a superior ovary. If the ovary is inferior a line is put above the figure, *e.g.* G(5). If the stamens are fused to the corolla, a long bracket is used to join the C and the A, *e.g.* C(5)A(5). Other methods of fusion are indicated similarly. Examples:

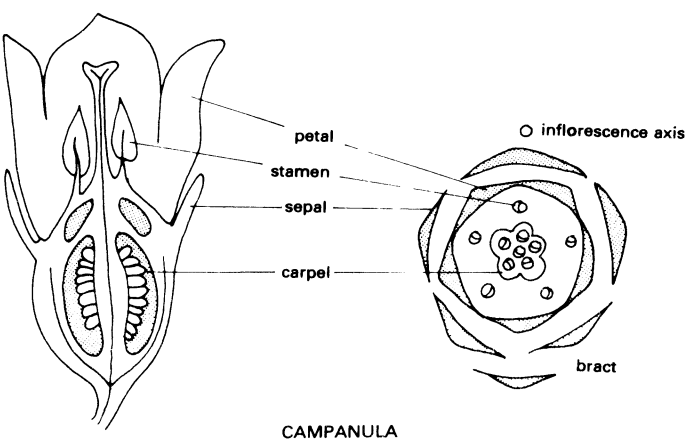
(a) K(5)C(5)A5G(5): five united sepals, 5 united petals, 5 free stamens fused to the petals, 5 fused carpels, superior ovary;

(b) K5C(5)A5G(5): five free sepals, 5 united petals, 5 free stamens, 5 united carpels, an inferior ovary;

(c) P(3 + 3)A3G(3): perianth of 6 segments in two undifferentiated whorls, 3 free stamens fused to 3 perianth segments, 3 fused carpels, superior ovary;

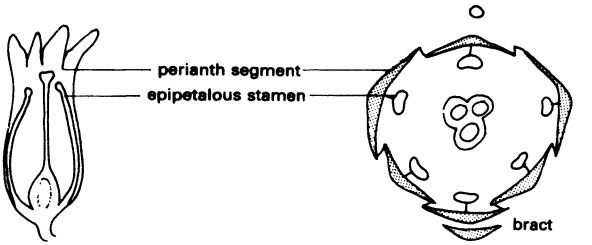
(d) K(5)C5A(5 + 5)G1: five united sepals, 5 free petals, two groups of 5 fused stamens, one carpel, superior ovary;

(e) K5C5A∞G∞: 5 free sepals, 5 free petals, numerous stamens, numerous carpels, superior ovary. ↓ HALF-FLOWER · FLORAL DIAGRAM ↑ INFLORESCENCE



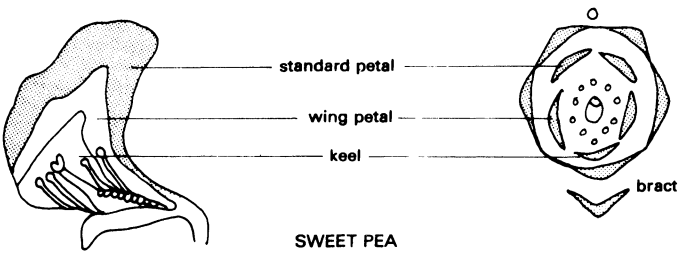
CAMPANULA

floral formula K5 C(5) A5 G(5)



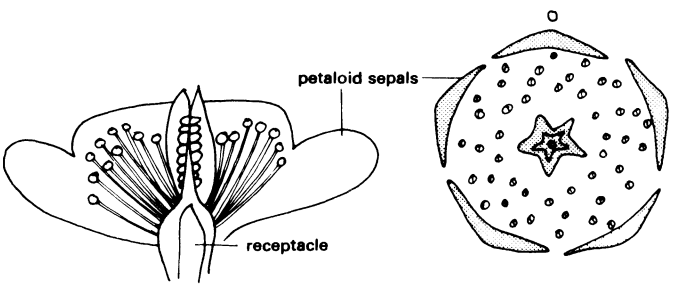
BLUEBELL

floral formula P(3+3)A3+3G(3)



SWEET PEA

floral formula K(5) C(5) A(5+5) G1



MARSH MARIGOLD

floral formula K5A∞ G5

HALF-FLOWERS AND FLORAL DIAGRAMS

SF107 half-flower (*n.*) A median longitudinal section of a flower. ↑ FLORAL FORMULA

SF108 floral diagram (*n.*) A diagram showing the number and related position of the parts of the four whorls of a flower. This together with a half-flower and a floral formula give the requisite information to describe a flower fully. ↑ FLORAL FORMULA

SF109 racemose (*adj.*) Describes an inflorescence with monopodial branching; the five types of racemose inflorescences are: raceme, spike, umbel, corymb and capitulum. ↓ CYMOSE · MONOCHASIAL · DICHASIAL · GLOMERULATE ↑ INFLORESCENCE · RACEME → MONOPODIAL

SF110 cymose (*adj.*)Describes an inflorescence with sympodial branching; a flower forms at the apex of the axis, then an axillary branch grows and a flower forms at the apex of the branch; a further axillary branch arises from the first axillary branch and the process is repeated. The axillary branches can be single (a **monochasium**) or paired (a **dichasium**). ↑ RACEMOSE

SF111 monochasial (*adj.*) Describes a cymose inflorescence in which one axillary branch arises on an axis or on a branch. ↑ RACEMOSE · MONOCHASIUM

SF112 dichasial (*adj.*) Describes a cymose inflorescence in which two axillary branches

arise at the same level on an axis or on a branch. ↑ RACEMOSE · DICHASIUM

SF113 glomerulate (*adj.*) Describes flowers arranged in clusters or grouped in glomerules. ↑ RACEMOSE → GLOMERULE

SF114 isomerous (*adj.*) (Of a flower) having equal numbers of parts in each whorl. —***isomery*** (*n.*) ↓ ANISOMEROUS · SECUND (An) ↑ INFLORESCENCE

SF115 anisomerous (*adj.*) (Of a flower) having unequal numbers of parts in the floral whorls. —***anisomery*** (*n.*) ↑ ISOMEROUS (Hn)

SF116 secund (*adj.*) (Of flowers and leaves) arranged on one side only. ↑ ISOMEROUS

SF117 gynoecium (*n.,pl.* **gynoecia**) The collective female reproductive organs of a flower; it consists of one or more ovaries, styles, and stigmas, *i.e.* the carpels. ↓ CARPEL · SUPERIOR GYNOECIUM · PISTILLIDIUM · CARPELLATE · APOCARPOUS · STYLOID ↑ FLOWER

SF118 carpel (*n.*) The female reproductive organ of a flowering plant, consisting of an ovary and a stigma which is often borne on a style. Flowers can possess one or more carpels; together they form the gynoecium. A carpel is a megasporophyll. —CARPELLATE (*adj.*) ↓ PISTIL · OVARY[2] · SUPERIOR OVARY · INFERIOR OVARY · OVARIUM · STIGMA[1] · STYLE[1] · GYNAECIUM ↑ GYNOECIUM → STAMEN (Cm)

SF119 pistil (*n.*) **1** An alternative term for **gynoecium.** **2** A separate carpel of an apocarpous gynoecium. —PISTILLATE (*adj.*) ↑ CARPEL → ANDROECIUM (P)

SF120 ovary[2] (*n.*) The hollow region at the base of a carpel; it contains one or more ovules. In a syncarpous gynoecium, the ovaries are united to form a compound ovary. In monocarpous, apocarpous gynoecia, there are one or more simple ovaries. ↑ CARPEL

SF121 superior ovary (*n.*) When the carpels are at the apex of a conical receptacle or at the centre of a concave receptacle, the ovary is superior. ↓ INFERIOR OVARY (An) ↑ CARPEL → FLOWER STALK

SF122 inferior ovary (*n.*) When the carpels are completely enclosed by and fused with the receptacle, the ovary is inferior. ↑ CARPEL · SUPERIOR OVARY (An) → FLOWER STALK

SF123 ovarium (*n.*) Alternative term for OVARY[2] (↑). ↑ CARPEL

SF124 stigma[1] (*n.,pl.* **stigmata** *or* **stigmas**) A structure forming the terminal surface of a carpel, or the structure at the terminal end of a style; it receives pollen grains. The stigma is sticky if the pollen grains are heavy, and feathery if the pollen grains are light □ *stigmas mature before pollen can be received* —***stigmatic*** (*adj.*) ↑ CARPEL

SF125 style[1] (*n.*) An elongation of the carpel, found in many flowering plants; it carries the stigma into a more prominent position in the flower. —STYLOID (*adj.*) ↑ CARPEL

SF126 gynaecium (*n.,pl.* **gynaecia**) An alternative term for GYNOECIUM (↑). ↑ CARPEL

SF127 superior gynoecium (*n.*) Alternative term for SUPERIOR OVARY (↑).

SF128 inferior gynoecium (*n.*) Alternative term for INFERIOR OVARY (↑).

SF129 pistillidium (*n.*) The female sexual organ of bryophytes, pteridophytes, and gymnosperms. ↑ GYNOECIUM

SF130 column[2] (*n.*) A continuation of the flower stalk of orchids with a pollenium at the top of the column. The stigma is a hollow on the front of the column and just below the pollenium; its interior has a sticky surface to receive pollen grains. The column is a style united with stamens, with an inferior ovary. ↑ PISTILLIDIUM → POLLINIUM

SF131 carpellate (*adj.*) Possessing carpels. Contrast **pistillate**, which means carpellate without stamens. ↓ MONOCARPOUS · BICARPELLATE · POLYCARPOUS · MONOGYNOUS · POLYGYNOUS · MONOCARPELLARY · BICARPELLARY · POLYCARPELLARY ↑ GYNOECIUM → PISTILLATE (H)

SF132 monocarpous (*adj.*) (Of angiosperms) having only one ovary developed from the gynoecium, *i.e.* having only one carpel. Contrast **monocarpic**, which means fruiting once only. ↑ CARPELLATE → MONOCARPIC[1] · MONANDROUS (An)

SF133 bicarpellate (*adj.*) (Of angiosperms) having two ovaries developed from the gynoecium. ↑ CARPELLATE → DIANDROUS (An)

SF134 polycarpous (*adj.*) (Of angiosperms) having numerous carpels. Contrast **polycarpic**, which means fruiting season after season. ↑ CARPELLATE → POLYCARPIC[1] · POLYANDROUS (An)

SF135 monogynous (*adj.*) Describes a flower with only one pistil. ↑ CARPELLATE

SF136 polygynous (*adj.*) Describes a flower possessing many separate styles. ↑ CARPELLATE

SF137 monocarpellary (*adj.*) Alternative term for MONOCARPOUS (↑).

SF138 bicarpellary (*adj.*) Alternative term for BICARPELLATE (↑).

SF139 polycarpellary (*adj.*) Describes a flower with a compound gynoecium; POLYCARPOUS. ↑ CARPELLATE

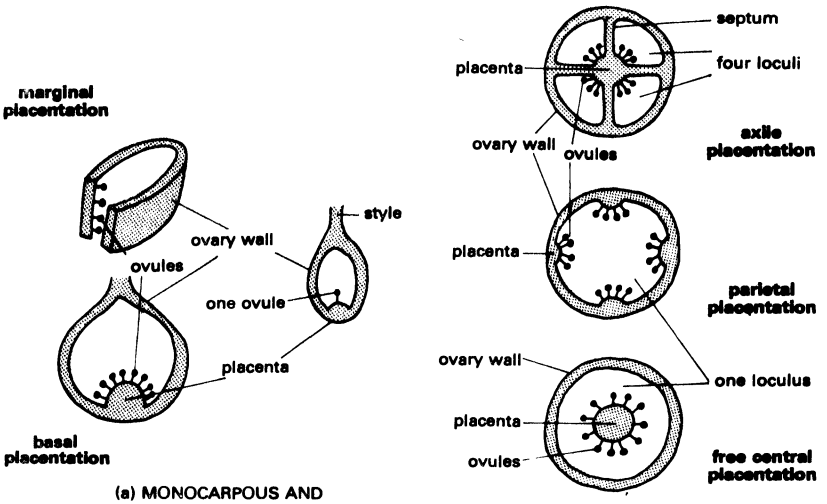
SF140 apocarpous (*adj.*) Describes the gynoecium of an angiosperm having separate carpels. ↓ SYNCARPOUS ↑ GYNOECIUM

SF141 syncarpous (*adj.*) Describes the gynoecium of an angiosperm having united carpels. ↑ APOCARPOUS

SF142 styloid (*adj.*) Like a style in shape. ↑ GYNOECIUM

SF143 placenta[2] (*n.,pl.* **placentae** *or* **placentas**) **1** The part of the ovary wall to which the ovules are attached; it is well provided with vascular tissue. **2** (In ferns) a structure on which sporangia are borne. —PLACENTATION (*n.*) ↓ LOCULUS · PLACENTATION[2] · LOCULAR · MARGINAL PLACENTATION ↑ FLOWER · OVARY[2]

SF144 loculus (*n.,pl.* **loculi**) **1** A small chamber or cavity. **2** (In some fungi) a cavity in the stroma, containing asci. **3** A cavity in an anther. **4** (In a compound carpel) a cavity



PLACENTATION

in the ovary. In most ovaries there are the same number of loculi as there are of carpels; in other ovaries the walls between the united carpels disappear and leave one loculus; in a few others new walls appear so there are more loculi than carpels. An ovary with 5 loculi is common in dicotyledons, and one with 3 loculi is common in monocotyledons. —LOCULAR, ***loculate*** (*adj.*) ↓ LOCULE ↑ PLACENTA[2]

SF145 locule (*n.*) Alternative term for LOCULUS (↑).

SF146 placentation[2] (*n.*) The arrangement of the ovules in an ovary. When the gynoecium is monocarpous or apocarpous, the placentation can be marginal, apical, or basal. When the gynoecium is syncarpous the placentation can be axile, parietal, or free-central. (See diagram) ↑ PLACENTA[2]

SF147 locular (*adj.*) Of or to do with loculi; possessing loculi, as in **bilocular** (having 2 loculi), **trilocular** (3 loculi) and **pentalocular** (5 loculi). ↑ PLACENTA[2]

SF148 marginal placentation (*n.*) Placentation in which the placenta appears as one ridge on the ovary wall and ovules are attached to the placenta in a row, *e.g.* as peas in a pod; it occurs in monocarpous and apocarpous ovaries. ↓ BASAL PLACENTATION · PARIETAL PLACENTATION · AXILE PLACENTATION · FREE-CENTRAL PLACENTATION ↑ PLACENTA[2]

SF149 basal placentation (*n.*) Placentation in which the placenta is formed at the base of monocarpous and apocarpous ovaries, with numerous ovules attached to it. If there is only one ovule in an ovary, it is usually attached to the base of the ovary, *e.g.* as in the sunflower and different grasses. ↑ MARGINAL PLACENTATION

SF150 parietal placentation (*n.*) Placentation in which the edges of the carpels fuse together and the dividing walls disappear, leaving one loculus. The placentas from each carpel appear as parietal placentation ridges on the ovary wall, and have numerous ovules on them. It occurs in syncarpous ovaries. ↑ MARGINAL PLACENTATION

SF151 axile placentation (*n.*) Placentation in which the edges of the carpels fuse together to form a single central placenta; numerous ovules are arranged on the placenta. The ovary is divided into a number of loculi by the walls of the carpels. Axile placentation occurs in syncarpous ovaries. ↑ MARGINAL PLACENTATION

SF152 free-central placentation (*n.*) Placentation in which the edges of the carpels fuse together and the dividing walls disappear, leaving one loculus. A placenta appears at the base of the ovary and has numerous ovules on it. This condition is homologous with basal placentation of apocarpous ovaries; it occurs in syncarpous ovaries. ↑ MARGINAL PLACENTATION

SF153 androecium (*n.*) The collective male reproductive parts of a flower; it consists of numerous stamens. ↓ STAMEN · POLLEN · STAMINODE · HOMOSTYLY · STAMINAL · MONANDROUS · MONADELPHOUS ↑ FLOWER · GYNOECIUM (Cm)

SF154 stamen (*n.*) The male reproductive organ of a flowering plant; it consists of a filament and an anther. A stamen is a microsporophyll □ *some stamens ripen before stigmas mature* —STAMINATE,

STAMINAL, STAMINIFEROUS (*adj.*) STAMINODE (*n.*) ↓ ANTHER · FILAMENT[3] · POLLEN SAC · CONNECTIVE[2] · TASSEL ↑ ANDROECIUM → CARPEL (Cm) · STAMINATE

SF155 anther (*n.*) The terminal portion of a stamen, consisting of two lobes united by a part of the filament. In each lobe there are two pollen sacs. When the anther is ripe it dehisces and releases pollen. Anthers have evolved from microsporangia □ *anthers ripen on stamens; ripe anthers dehisce* ↑ STAMEN → OVULE (Cm)

SF156 filament[3] (*n.*) The stalk supporting an anther. ↑ STAMEN

SF157 pollen sac (*n.*) A cavity (**loculus**) in the lobe of an anther; in it pollen is produced. ↑ STAMEN → LOCULUS

SF158 connective[2] (*n.*) A structure joining together two lobes of an anther and itself joined to the filament. ↑ STAMEN

SF159 tassel (*n.*) One of the male flowers of a maize plant. ↑ STAMEN

SF160 pollen (*n.*) The mass of dust-like microspores produced by anthers in angiosperms and by microsporangia on cones in gymnosperms. The pollen is carried by wind or by insects, and very rarely by water, to ovules of gymnosperms or to stigmas of angiosperms, where the pollen grains germinate □ *pollen is produced by anthers; pollen is spread by various agents* —POLLINATION (*n.*) POLLINIFEROUS (*adj.*) ***pollinate*** (*v.*) ↑ ANDROECIUM → POLLINATION

SF161 pollinium (*n.,pl.* **pollinia**) A small mass of pollen grains, stuck together, arranged in relation to a sticky plate-like or stem-like part, which adheres to visiting insects. There are two pollinia at the top of the column of an orchid, covered by a small cap. ↑ POLLEN → COLUMN[2]

SF162 staminode (*n.*) A sterile stamen, *i.e.* one which does not produce pollen. ↑ ANDROECIUM

SF163 homostyly (*n.*) (Of a plant species) the condition of having only one arrangement of stigma and style, *i.e.* either thrum-eyed or pin-eyed; this is the common condition in flowers. —***homostylous*** (*adj.*) ↓ HETEROSTYLY (An) ↑ ANDROECIUM

SF164 heterostyly (*n.*) (Of a plant species) the condition of having more than one arrangement of length of the style and stigma, *e.g.* some are pin-eyed, some are thrum-eyed, and some have anthers and stigmas at the same level. Heterostyly ensures cross-pollination by visiting insects. —***heterostylous*** (*adj.*) ↑ HOMOSTYLY (An)

SF165 staminal (*adj.*) Of or to do with stamens. ↓ STAMINIFEROUS · EPIPETALOUS · DIDYNAMOUS · POLLINIFEROUS · THRUM-EYED · PIN-EYED ↑ ANDROECIUM → STAMINATE

SF166 staminiferous (*adj.*) (Of flowers) bearing stamens. Contrast **staminate**, which means bearing stamens but no carpels. ↑ STAMINAL → STAMINATE (H)

SF167 epipetalous (*adj.*) Describes stamens borne on petals with the base of the filament fused to the petal and the filament branching off from the petal. ↑ STAMINAL

SF168 didynamous (*adj.*) (Of flowers) possessing a pair of long stamens and a pair of short stamens, *i.e.* 4 stamens in all. ↑ STAMINAL

SF169 polliniferous (*adj.*) Describes a structure which bears or produces pollen, *e.g.* anthers are polliniferous, staminodes are not polliniferous. ↑ STAMINAL

SF170 thrum-eyed (*adj.*) Describes a flower possessing a short style and long stamens which reach to the mouth of the corolla tube. ↓ PIN-EYED (An) ↑ STAMINAL

SF171 pin-eyed (*adj.*) Describes a flower possessing a long style, with the stigma at the mouth of the corolla tube, and short stamens. ↑ STAMINAL · THRUM-EYED (An)

SF172 monandrous (*adj.*) **1** (Of plants) having only one free stamen. **2** (Of female animals) having only one male mate. —MONANDRY (*n.*) ↓ DIANDROUS · POLYANDROUS · OBDIPLOSTEMONOUS ↑ ANDROECIUM · STAMEN → ANANDROUS · MONOCARPOUS (An)

SF173 diandrous (*adj.*) (Of a plant) having two free stamens. —***diandry*** (*n.*) ↑ MONANDROUS → BICARPELLATE (An)

SF174 polyandrous (*adj.*) **1** Describes a plant having 20 or more free stamens. **2** Describes a female animal mating with several males, *e.g.* female fish. —POLYANDRY (*n.*) ↑ MONANDROUS (An) → POLYCARPOUS (An)

SF175 obdiplostemonous (*adj.*) Describes a flower with stamens in two whorls, the outer whorl opposite the petals and the inner whorl opposite the sepals. Contrast the general arrangement in which stamens usually alternate with petals. ↑ MONANDROUS

SF176 monadelphous (*adj.*) **1** Describes stamens united by their filaments to form a tube surrounding the style, *e.g.* lupin, *Hibiscus*. **2** Describes a flower with its stamens in this arrangement. ↓ DIADELPHOUS · TRIADELPHOUS · PENTADELPHOUS · TETRADYNAMOUS · POLYADELPHOUS ↑ ANDROECIUM

SF177 diadelphous (*adj.*) Describes stamens united by their filaments to form two groups of stamens, or a group of stamens and a solitary stamen, *e.g.* as in the pea. **2** Describes a flower with its stamens in this arrangement. ↑ MONADELPHOUS

SF178 triadelphous (*adj.*) **1** Describes stamens united by their filaments to form three groups of stamens. **2** Describes a flower with its stamens in this arrangement. ↑ MONADELPHOUS

SF179 pentadelphous (*adj.*) Describes stamens united by their filaments to form five groups of stamens. **2** Describes a flower with its stamens in this arrangement. ↑ MONADELPHOUS

SF180 tetradynamous (*adj.*) Describes an androecium, or flower, with four long stamens and two short ones, *e.g.* as in the flowers of cabbage plants. ↑ MONADELPHOUS

SF181 polyadelphous (*adj.*) **1** Describes stamens united by their filaments to form groups of stamens. **2** Describes a flower

with its stamens in this arrangement. ↑ MONADELPHOUS

SF182 fruit body (*n.*) A structure bearing spores, *e.g.* a basidiocarp, a conidiocarp, a sporangiocarp. ↓ FRUITING BODY · PILEUS ↑ FLOWER

SF183 fruiting body (*n.*) Alternative term for FRUIT BODY. ↓ HYMENIUM · PARAPHYSIS · APOTHECIUM ↑ FRUIT BODY

SF184 hymenium (*n., pl.* **hymenia**) (In some fungi) a layer of spore-producing structures occurring in fruiting bodies. The structures have a regular arrangement and are formed of asci or basidia. ↑ FRUITING BODY

SF185 paraphysis (*n., pl.* **paraphyses**) A sterile filament, found in mosses, some algae, and the hymenia of fungi, growing amongst the sex organs. ↑ FRUITING BODY

SF186 apothecium (*n.*) (In lichens and cup-fungi) a cup-shaped fruiting body with a hymenium formed of asci and paraphyses. ↑ FRUITING BODY

SF187 pileus (*n.*) **1** (In fungi) the umbrella-shaped cap of a mushroom-type fruiting body. **2** The umbrella-shaped cap of a medusa. ↓ GILLS[2] · STIPE[2] · LAMELLAE[3] ↑ FRUIT BODY → MEDUSA

SF188 gills[2] (*n., pl.*) Radially arranged structures in the underside of a pileus; the gills bear the hymenia. Also called ***lamellae.*** ↑ PILEUS

SF189 stipe[2] (*n.*) The stalk bearing the fruiting body of fungi, such as mushrooms. ↑ PILEUS

SF190 lamellae[3] (*n., pl.*) Alternative term for GILLS[2] (↑).

SF191 sex organs[2] (*n., pl.*) (In plants) the structures which produce gametes. ↓ GAMETOPHYLL · PERICHAETIUM · SORUS · RECEPTACLE[2] · TRICHOGYNE · ARCHICARP ↑ FLOWER

SF192 gametophyll (*n.*) A modified leaf carrying sexual organs, *i.e.* a megasporophyll or a microsporophyll. ↑ SEX ORGANS[2]

SF193 perichaetium (*n., pl.* **perichaetia**) (In mosses) a whorl of leaves surrounding the archegonia or antheridia. ↓ PERIGONIUM ↑ SEX ORGANS[2]

SF194 perigonium (*n., pl.* **perigonia**) (In mosses) a whorl of leaves surrounding the base of the antheridium. ↑ PERICHAETIUM

SF195 sorus (*n.,pl.* **sori**) **1** (In ferns) a group of sporangia on the under surface of a pinnule. **2** (In seaweeds) a group of antheridia on a frond. **3** The sporangia of certain fungi. —***soriferous*** (*adj.*) ↓ INDUSIUM ↑ SEX ORGANS[2]

SF196 indusium (*n., pl.* **indusia**) **1** (In some ferns) a membranous outgrowth of epidermis, covering and protecting a sorus. **2** (In some flowers) a cup-like fringe of hairs surrounding a stigma. ↑ SORUS

SF197 receptacle[2] (*n.*) In some brown algae, the swollen terminal end of a frond of the thallus; mucilage causes the swelling and the structure encloses the reproductive organs. ↓ CONCEPTACLE · OSTIOLE ↑ SEX ORGANS[2]

SF198 conceptacle (*n.*) (In some brown algae) a spherical cavity in the receptacle; it contains sex organs which produce either microgametes or megagametes. ↑ RECEPTACLE[2]

SF199 ostiole (*n.*) A small opening in the receptacle of algae, leading to the conceptacle. ↑ RECEPTACLE[2]

SF200 trichogyne (*n.*) (In some algae, some fungi and lichens) a tubular structure projecting from the female sex organ, through which the male gametes are received and gain access to the female gamete. ↑ SEX-ORGANS

SF201 archicarp (*n.*) A spiral structure on a thallus, bearing an oogonium; it grows from the mycelium of fungi of the Ascomycetes gain access to the female gamete. ↑ SEX ORGANS[2]

formed by some Annelida to protect the

Life Cycles

SG001 life cycle (*n.*) The progressive succession of changes through which an organism goes from the start of its development as a fertilized egg until its death as an adult, *e.g.* the life cycle of many insects of egg-larva-pupa-imago-death. In cases where there is an alternation of generations, the life cycle goes from the start of its development to the stage at which it begins an identical series of changes, *e.g.* the life cycle of a jelly fish— medusa-gametes-zygote-polyp-medusa. ↓ LIFE HISTORY · NEOTENY · JUVENILE · AUTOECIOUS · PHYLOGENETIC · IMAGO · METAMORPHOSIS · COCOON[2] · COURTSHIP → REPRODUCTION · MEDUSA

SG002 life history (*n.*) The succession of changes through which an organism, or one stage of its life cycle, proceeds from birth or formation, to death or progressive change, *e.g.* ***a*** the life history of a vertebrate is from the union of gametes to death; ***b*** the life history of a medusa is from the stage of budding on a polyp to the formation of gametes. The life history can thus be the life cycle in some cases, as in vertebrates, or only part of the life cycle, as in many coelenterates. ↓ ONTOGENY · PHYLOGENY[2] · RECAPITULATION THEORY ↑ LIFE CYCLE

SG003 ontogeny (*n.*) The life history of the whole course of the growth and development of one individual. —***ontogenetic*** (*adj.*) ↓ PHYLOGENY[2] (An) ↑ LIFE HISTORY

SG004 phylogeny[2] (*n.*) The history of the development of a species of organisms or of a race of organisms. —PHYLOGENETIC (*adj.*)

↑ LIFE HISTORY · ONTOGENY (An)

SG005 recapitulation theory (*n.*) The theory, as originally put forward, stated that the life history of an individual recapitulated the whole of its ancestry; this theory has now been discredited, as the embryo of man, for example, never resembles the actual form of an evolutionary ancestor. It is probably true however that the early development of an embryo resembles the corresponding embryonic stages of its ancestors, *e.g.* the gill slits of a bird embryo resemble the gill slits of an ancestral fish embryo. ↑ LIFE HISTORY

SG006 neoteny (*n.*) **1** The persistence of a larval or other pre-adult form of an animal, or the occurrence of adult characteristics in larvae. The persistence may be temporary (caused by climatic factors not being suitable for further metamorphosis) or it may be permanent. If neoteny is permanent, then paedogenesis must take place for the survival of the species. **2** The retarded development of any body structure. —***neotenic*** (*adj.*) ↓ PAEDOGENESIS ↑ LIFE CYCLE

SG007 paedogenesis (*n.*) Sexual reproduction by larval or other pre-adult forms of an organism. The condition arises from neoteny, *e.g.* as in the axolotl. ↑ NEOTENY

SG008 juvenile (*n.*) A young plant or a young animal before maturity, especially when the juvenile does not resemble the adult form; a human being before puberty. —***juvenile*** (*adj.*) ↑ LIFE CYCLE

SG009 autoecious (*adj.*) (Of parasitic fungi) using one host for different stages of their life cycle. ↓ HETEROECIOUS (An) ↑ LIFE CYCLE

SG010 heteroecious (*adj.*) (Of parasitic fungi) using different hosts for different stages of their life cycle, *e.g.* wheat rust requires wheat and *Berberis* as its two hosts in its life cycle. ↑ AUTOECIOUS (An)

SG011 phylogenetic (*adj.*) Of or to do with the history of a species of organism, *e.g.* phylogenetic cells are the reproductive cells of an organism, whereas autogenetic cells are somatic cells. ↓ AUTOGENETIC (An) ↑ LIFE CYCLE · PHYLOGENY[2]

SG012 autogenetic (*adj.*) Describes spontaneous reproduction, *e.g.* as in the reproduction of somatic cells. ↑ PHYLOGENETIC (An) → AUTOGENY

SG013 imago (*n.*) A sexually mature adult insect; the final stage of metamorphosis, whether complete or incomplete. ↓ LARVA[1] · PUPA · ECDYSIS · PUPATE · SHED[1] · LARVAL · COARCTATE ↑ LIFE CYCLE

SG014 larva[1] (*n.,pl.* **larvae**) The first stage (an embryo) in the life cycle of an arthropod which undergoes complete metamorphosis. Larvae are hatched from eggs; they do not resemble the adult form of the species; they are free living and self-sustaining but usually are incapable of sexual reproduction, *e.g.* a caterpillar. Other animals possess larval forms which are free living embryos, *e.g.* tadpoles and the larvae of many marine invertebrates. —LARVULE (*n.*) LARVAL, ***larviform,*** LARVIPAROUS, LARVIVAROUS (*adj.*) ↓ LARVULE · INSTAR · NYMPH · NAIAD · MAGGOT ↑ IMAGO → EMBRYO[2] (Sn) · LARVA[2]

SG015 larvule (*n.*) A young larva. ↑ LARVA[1]

SG016 instar (*n.*) (In insects) a stage in the development of a larva between two successive moults. ↓ ECDYSIS ↑ LARVA[1]

SG017 nymph (*n.*) The young, immature stage of insects that undergo incomplete metamorphosis. They resemble the adult form of the species in having compound eyes and similar mouth parts but differ in usually being incapable of sexual reproduction and in being wingless or having incompletely developed wings. They are adapted to a terrestrial habitat. The term is frequently used instead of **naiad** —***nymphal*** (*adj.*) ↓ NAIAD (Sn) · PAUROMETABOLA ↑ LARVA[1]

SG018 naiad (*n.*) A larval stage in incomplete metamorphosis; the naiad is adapted for an aquatic existence, possessing tracheal gills, whereas the adult is adapted for a terrestrial existence. Successive moults change the naiad into an imago, but because of the difference in habitat between a naiad and an imago, the naiad undergoes many more moults than a nymph. ↑ LARVA[1] · NYMPH (Sn) → HEMIMETABOLA

SG019 maggot (*n.*) The worm-like larva of an insect, without appendages or a distinct head, such as the larva of a house-fly. ↑ LARVA[1]

SG020 pupa (*n.,pl.* **pupae**) The resting stage in endopterygote insects between larva and imago. Feeding and locomotion cease, the organism is usually wrapped up in a pupal case or cocoon, and great structural alterations take place in the body of the organism. —***pupal*** (*adj.*) PUPATE (*v.*) ↓ CHRYSALIS · PUPARIUM · COCOON[1] ↑ IMAGO → COCOON[2]

SG021 chrysalis (*n.*) The pupal stage of butterflies, moths, and certain other insects. ↑ PUPA ↓ FLOSS

SG022 puparium (*n.*) The outer case of a pupa. ↑ PUPA

SG023 cocoon[1] (*n.*) A protective case spun by the larvae of many insects in which a pupa develops. The cocoon of the silkworm moth is the source of silk. ↑ PUPA

SG024 floss (*n.*) **1** A mass of short threads of silk in a cocoon. **2** A mass of plant hairs similar in appearance, *e.g.* the floss surrounding seeds of cotton. ↑ PUPA

SG025 ecdysis (*n.*) The periodic shedding (*i.e.* moulting) of the cuticle of immature arthropods. A single act of this kind is a moult and many arthropods undergo several moults. In ecdysis the cuticle splits along lines of weakness and the arthropod drags itself out, after absorbing the inner part of the cuticle. The new cuticle is soft and the arthropod takes in air to expand itself until the new cuticle is larger than the old one. The new cuticle hardens in the air. A hormone initiates ecdysis. Many reptiles also exhibit ecdysis at all stages of life; they shed or cast their skin □ *an animal exhibits*

ecdysis; ecdysis occurs in all arthropods; ecdysis is initiated by a hormone —***ecdysial*** (*adj.*) ↓ MOULT ↑ IMAGO

SG026 pupate (*v.i.*) To pass into the pupal stage of development. ↓ MOULT ↑ IMAGO

SG027 moult (*v.i.*) To cast off or to shed an outer covering of an animal, such as the cuticle of an arthropod, the skin of a reptile, the feathers of a bird, or the hair of a mammal. The action takes place at periodic intervals, depending on growth rate in some cases, and on seasonal changes in others □ *a snake moults and casts off its skin* —MOULT, ***moulting*** (*n.*) ***moulting*** (*adj.*) ↑ PUPATE

SG028 shed[1] (*v.t.*) To put off or to put out a small part of or a whole object from the main body of an organism. The focus is on the object being no longer necessary to the organism, *e.g.* a tree sheds its leaves (when the leaves die); a cat sheds hairs when the weather becomes warm (when fewer hairs are needed). ↑ IMAGO → CAST[2] · SLOUGH[2]

SG029 cast[2] (*v.*) See CAST[1] **(CF036).**

SG030 slough[2] (*v.*) See SLOUGH[1] **(CF037).**

SG031 larval (*adj.*) Of, or to do with, larvae, *e.g.* the larval stage of development. ↓ LARVIPAROUS · LARVIVAROUS ↑ IMAGO

SG032 larviparous (*adj.*) Producing live larvae, as opposed to larvae that hatch out of eggs. ↑ LARVAL

SG033 larvivarous (*adj.*) Describes organisms that feed on larvae, *e.g.* fish feeding on mosquito larvae are larvivarous. ↑ LARVAL

SG034 coarctate (*adj.*) Describes a pupa with a case, *e.g.* pupa coarctata, also called a coarctate pupa. A pupa without a case is **pupa libera.** ↑ IMAGO

SG035 metamorphosis (*n.*) A marked and rapid transformation from the pre-adult form of an animal to the adult form, *e.g.* the transformation from larva to adult in insects. The transformation often involves considerable destruction of tissues and growth of new ones; the destruction is brought about by lysosomes □ *an insect may undergo metamorphosis* —***metamorphic*** (*adj.*) ***metamorphose*** (*v.*) ↓ COMPLETE METAMORPHOSIS · HOLOMETABOLA · HOLOMETABOLISM · METAMORPHOSE ↑ LIFE CYCLE → LYSOSOME

SG036 complete metamorphosis (*n.*) (In insects) metamorphosis which includes the stages of larva, pupa, and imago. ↓ INCOMPLETE METAMORPHOSIS ↑ METAMORPHOSIS → ENDOPTERYGOTA[2]

SG037 incomplete metamorphosis (*n.*) (In insects) metamorphosis with only the stages of nymph and adult. ↑ COMPLETE METAMORPHOSIS → EXOPTERYGOTA[1]

SG038 Holometabola (*n.pl.*) A category of insects which undergo complete metamorphosis, *e.g.* a butterfly. —HOLOMETABOLISM (*n.*) ***holometabolous*** (*adj.*) ↓ ENDOPTERYGOTA[2] · HEMIMETABOLA · HETEROMETABOLA · PAUROMETABOLA · AMETABOLA · EXOPTERYGOTA[1] ↑ METAMORPHOSIS

SG039 Endopterygota[2] (*n.pl.*) Alternative term for HOLOMETABOLA (↑).

SG040 Hemimetabola (*n.pl.*) A category of insects in which the larval form differs from the adult form in being adapted to an aquatic existence. The larval form is a naiad which undergoes many moults, gradually reaching adult size and preparing to develop into the winged adult. Metamorphosis is incomplete, but development is not direct, as the instar develops for its aquatic existence, *e.g.* may flies, dragonflies. —HEMIMETABOLISM (*n.*) ***hemimetabolous*** (*adj.*) ↓ HETEROMETABOLA (Sn) ↑ NAIAD · HOLOMETABOLA

SG041 Heterometabola (*n.pl.*) Alternative term for HEMIMETABOLA (↑). —***heterometabolism*** (*n.*) ***heterometabolous*** (*adj.*) ↑ HOLOMETABOLA · HEMIMETABOLA (Sn)

SG042 Paurometabola (*n.pl.*) A category of insects in which the larval form resembles the adult form in all but size, possession of wings, and some minor details. The larval form is a nymph which undergoes several moults, gradually reaching adult size and growing wings. Metamorphosis is incomplete and gradual, *e.g.* as in grasshoppers, true bugs, and termites. —PAUROMETABOLISM (*n.*) ***paurometabolous*** (*adj.*) ↑ HOLOMETABOLA → NYMPH

SG043 Ametabola (*n.pl.*) A category of insects in which the larval form completely resembles the adult in all but size. They do not undergo metamorphosis, but gradually attain adult size after a few moults. The category is identical with the sub-class of insects, *Apterygota*, which includes silverfish and bristletails. —AMETABOLISM (*n.*) ***ametabolous*** (*adj.*) ↑ HOLOMETABOLA

SG044 Exopterygota[1] (*n.pl.*) A category of insects which undergo incomplete metamorphosis and develop by successive moults. It includes Hemimetabola and Paurometabola. —***exopterygote*** (*adj.*) ↑ ENDOPTERYGOTA[2] (An) · HOLOMETABOLA

SG045 holometabolism (*n.*) (Of insects) the condition of undergoing complete metamorphosis. ↓ HEMIMETABOLISM · PAUROMETABOLISM · AMETABOLISM ↑ METAMORPHOSIS

SG046 hemimetabolism (*n.*) (Of insects) the condition of undergoing incomplete metamorphosis with the larval stage differing greatly from the adult stage. ↑ HOLOMETABOLISM

SG047 paurometabolism (*n.*) (Of insects) the condition of undergoing incomplete metamorphosis with the larval stage strongly resembling the adult stage. ↑ HOLOMETABOLISM

SG048 ametabolism (*n.*) (In insects) the condition of not undergoing metamorphosis. ↑ HOLOMETABOLISM

SG049 metamorphose (*v.i.*) To undergo metamorphosis, *e.g.* a mosquito metamorphoses from an egg to a larva, to a pupa, and finally to an imago. ↑ METAMORPHOSIS

SG050 cocoon[2] (*n.*) A horny protective case

eggs before one young immature worm emerges; the remaining eggs are consumed by the embryo. ↓ TROCHOPHORE · AMMOCOETE ↑ LIFE CYCLE

SG051 trochophore (*n.*) One of the small, planktonic, transparent, free-swimming, ciliated larvae of Polychaeta Mollusca, and Rotifera. They are spherical in shape and possess a band of cilia encircling the body in front of the mouth, and another group of cilia forming sense organs. ↓ TROCHOSPHERE · VELIGER ↑ COCOON[2]

SG052 trochosphere (*n.*) Alternative term for TROCHOPHORE (↑).

SG053 veliger (*n.*) The second larval stage of Mollusca; it develops from a trochophore. The bands of cilia become enlarged and a velum and other adult structures, such as the foot and shell, are developed. ↑ TROCHOPHORE

SG054 ammocoete (*n.*) The larva of a cyclostome. ↑ COCOON[2]

SG055 courtship (*n.*) An innate pattern of behaviour which certain vertebrates carry out before mating. It is most common in birds, and includes such acts as the male displaying his plumage, dancing, or bringing food or nesting materials to the female. ↓ NEST · FRY · SPAWN[1] · NIDICOLOUS ↑ LIFE CYCLE

SG056 nest (*n.*) A bed, or shelter, made by birds, insects, and some fishes, for the purpose of holding eggs until they hatch and, in the case of birds and some mammals, the offspring until they are mature enough to be self-sufficient. —NESTLING (*n.*) ***nesting*** (*adj.*) ***nest*** (*v.*) ↓ NIDUS · NESTLING · CROP-MILK ↑ COURTSHIP

SG057 nidus (*n.*) Alternative term for NEST (↑), especially an insect nest.

SG058 nestling (*n.*) A bird too young to leave the nest. ↑ NEST

SG059 crop-milk (*n.*) (In male and female pigeons) a secretion from crop epithelium; it is used to nourish nestlings. Secretion is controlled by the hormone prolactin. ↑ NEST

SG060 fry (*n.,pl.* **fry**) A newly hatched young fish. ↓ SPAWN[1] ↑ COURTSHIP

SG061 spawn[1] (*n.*) **1** A mass of small eggs, such as produced by fishes and frogs. **2** Mycelium of a food fungus, *e.g.* mushroom, which can be used to propagate the plant. —SPAWN (*v.*) ↑ FRY

SG062 spawn[2] (*v.t.,i.*) (Of fishes and other aquatic animals) to deposit eggs. ↓ SHED[2] ↑ COURTSHIP

SG063 shed[2] (*v.t.*) (Of fishes) to expel spermatozoa, *i.e.* a male fish sheds spermatozoa over the eggs spawned by a female. ↑ SPAWN[2]

SG064 nidicolous (*adj.*) (Of birds) hatching in an undeveloped stage and living in the nest for some time after hatching. ↓ NIDIFUGOUS ↑ COURTSHIP

SG065 nidifugous (*adj.*) (Of birds) hatching in a relatively developed stage and leaving the nest very soon after hatching. ↑ NIDICOLOUS

General Embryology

SH001 zygote[1] (*n.*) (In plants) a cell formed by the union of two gametes. ↓ EMBRYO[1] · SEGMENTATION[2] · ZYGOTE[2] → ZYGOSPORE

SH002 embryo[1] (*n.*) A young plant that develops from an egg cell either by sexual reproduction or by parthenogenetic reproduction. In seed plants the embryo consists of a plumule, a radicle, and one or more cotyledons. The embryo is dependent upon the food reserves supplied by the parent. —EMBRYONIC (*adj.*) ↓ PLUMULE · RADICLE ↑ ZYGOTE[1]

SH003 plumule (*n.*) The terminal bud of an embryo in a fully developed seed; it organizes the development of the main stem of the future plant. ↑ EMBRYO[1]

SH004 radicle (*n.*) The root of an embryo in a fully developed seed; it organizes the rooting system of the plant. ↑ EMBRYO[1]

SH005 segmentation[2] (*n.*) Cleavage, especially in plants, *i.e.* rapid and repeated mitosis, starting with the zygote, or egg cell, and resulting in a mass of undifferentiated cells. ↑ ZYGOTE[1]

SH006 zygote[2] (*n.*) (In animals) the diploid cell formed by the fertilization of an ovum by a male gamete; the zygote is the first cell of a new generation before it undergoes cleavage. —***zygotic*** (*adj.*) ↓ CLEAVAGE · EMBRYO[2] · MORULA · EMBRYOGENESIS · EMBRYONIC · GERMINAL · HOLOBLASTIC · BLASTULA · GASTRULA · NEURULA · EMBRYONIC MEMBRANES · EGG ↑ ZYGOTE[1]

SH007 cleavage (*n.*) Rapid and repeated mitosis, starting with the original zygote and resulting in a mass of cells; during the process the embryo grows in size. Also called ***segmentation*** but cleavage usually refers to animal zygotes. ↓ BILATERAL CLEAVAGE · SPIRAL CLEAVAGE · COMPLETE CLEAVAGE ↑ ZYGOTE[2]

SH008 bilateral cleavage (*n.*) (In vertebrates and many other groups of animals) a method of cleavage in which the arrangement of the blastomeres exhibits bilateral symmetry, *i.e.* the two halves of the mass of cells are mirror images of each other. Compare **spiral cleavage.** ↓ BLASTOMERE ↑ CLEAVAGE

SH009 spiral cleavage (*n.*) (In Turbellaria, Annelida, and Mollusca) a method of cleavage which first produces four large cells at the vegetal pole and four small cells at the animal pole; the four small cells are oriented in a clockwise direction to the four large cells and lie above the grooves between the four large cells. Successive cleavages produce large cells and small cells

oriented alternately in anticlockwise and clockwise directions. This results in a characteristic spiral pattern of small cells and large cells. ↑ CLEAVAGE

SH010 complete cleavage (*n.*) Alternative term for holoblastic cleavage (see **SH025**). ↑ CLEAVAGE

SH011 embryo[2] An animal in the process of developing from a zygote, or from a parthenogenetically activated ovum, to an independent individual. In viviparous animals the embryo is contained in its mother's body; in oviparous animals the embryo is contained in egg membranes. The embryonic period ends when either the birth of the animal occurs or the animal hatches from an egg. The embryo obtains nourishment from its parent or from the egg. —EMBRYONIC, EMBRYONAL (*adj.*) EMBRYOGENY (*n.*) ↓ EMBRYOLOGY ↑ ZYGOTE[2]

SH012 embryology (*n.*) The study of the formation and development of embryos. ↑ EMBRYO[2]

SH013 morula (*n.*) (In animals) the embryo during the process of cleavage when the embryo consists of a ball of blastomeres. The morula develops into a blastula or a blastocyst. ↓ BLASTOMERE · MICROMERE · MEGAMERE · MACROMERE ↑ ZYGOTE[2] → BLASTULA · BLASTOCYST

SH014 blastomere (*n.*) One cell formed by cleavage from an animal zygote. There are two types of blastomeres: small cells (or micromeres), and large cells (or megameres). ↑ MORULA

SH015 micromere (*n.*) (In animal embryos) a small cell (a small blastomere) produced by division at the animal pole of an embryo, formed in the yolk-free region of the ovum. ↓ MEGAMERE (An) · MACROMERE (An) ↑ MORULA → ANIMAL POLE

SH016 megamere (*n.*) (In animal embryos) a large cell (a large blastomere) produced by division at the vegetal pole of the embryo, formed in the yolky region of the ovum. ↑ MORULA · MICROMERE (An) → VEGETAL POLE

SH017 macromere (*n.*) Alternative term for MEGAMERE (↑).

SH018 embryogenesis (*n.*) The processes by which an embryo is formed and develops; the origin, structure, and the functions of the embryo. ↓ EMBRYOGENY POLYEMBRYONY ↑ ZYGOTE[2]

SH019 embryogeny (*n.*) Alternative term for EMBRYOGENESIS (↑).

SH020 polyembryony (*n.*) **1** (In animals) the formation by fission of more than one embryo from a single zygote. The simplest example of polyembryony is monozygotic twins in human beings. In some insects, over 1,000 embryos may be formed from a single zygote. **2** (In plants) the formation of more than one embryo from a single ovule, this usually occurs by vegetative budding from a pro-embryo. ↑ EMBRYOGENESIS → MONOZYGOTIC

SH021 embryonic (*adj.*) **1** Of or to do with an embryo, *e.g.* an embryonic tissue. **2** Descriptive of any tissue or organ in its initial stages of development, *i.e.* the tissue or organ has a future development. ↓ EMBRYONAL · EXTRA-EMBRYONIC ↑ ZYGOTE[2]

SH022 embryonal (*adj.*) Describes a structure peculiar to an embryo, *e.g.* an embryonal organ is an organ in an embryo; the focus is on the situation of the organ. Compare **embryonic**: an embryonic organ is one which is as yet undeveloped; the focus is on the stage of development. ↑ EMBRYONIC

SH023 extra-embryonic (*adj.*) Of or to do with an embryo but outside the embryo proper, *e.g.* membranes such as the amnion or chorion; the yolk; the yolk-sac. The term describes structures developed from the zygote for the support, protection, or nourishment, of the actual embryo. ↑ EMBRYONIC

SH024 germinal (*adj.*) Of or to do with the start of growth, when the growth arises from a reproductive process, *e.g.* ***a*** germinal cells are those concerned in reproduction; ***b*** germinal epithelium from which sex cells arise; ***c*** germinal disc is a disc-like area on the yolk of an egg—the embryo develops from it. ↑ ZYGOTE[2]

SH025 holoblastic (*adj.*) Describes an animal embryo, the whole of which undergoes cleavage; it occurs in eggs with a little or a moderate amount of yolk. **Holoblastic cleavage** is also called ***complete cleavage.*** ↓ MEROBLASTIC (An) ↑ ZYGOTE[2]

SH026 meroblastic (*adj.*) Describes the process in which only a part of an animal embryo undergoes cleavage; it occurs in eggs with a large amount of yolk, such as hens' eggs; the yolk part of the egg remains undivided into cells and the embryo develops from a germinal disc. ↑ HOLOBLASTIC (An)

SH027 blastula (*n.*) (In animals) the name given to the stage of its development after the morula, *i.e.* at or near the end of cleavage and before gastrulation occurs. In animals with complete or holoblastic cleavage, the blastula consists of a hollow ball with a wall of cells. ↓ BLASTOCOELE · BLASTODERM · PRIMITIVE STREAK · BLASTOCYST ↑ ZYGOTE[2]

SH028 blastocoele (*n.*) The cavity in a blastula, it is surrounded by a wall of cells. ↓ BLASTOCOEL ↑ BLASTULA

SH029 blastocoel (*n.*) Alternative term for BLASTOCOELE. ↑ BLASTOCOELE

SH030 blastoderm (*n.*) **1** The layer of cells surrounding a blastocoele. **2** (In the ova of insects) the layer of cells surrounding the yolk. **3** A sheet of cells formed by meroblastic cleavage in a megalecithal egg. —***blastodermal*** (*adj.*) ↓ BLASTODISC · GERMINAL DISC · SUBGERMINAL CAVITY · AREA PELLUCIDA · AREA OPACA · AREA VASCULOSA

SH031 blastodisc (*n.*) The blastoderm of a megalecithal ovum of a vertebrate, *e.g.* the disc of embryonic protoplasm at the animal pole of the yolk of a hen's egg. ↑ BLASTODERM → MEGALECITHAL

SH032 germinal disc (*n.*) Alternative term

for BLASTODISC (↑).

SH033 subgerminal cavity (*n.*) A slit-like cavity separating the germinal disc from the yolk. ↑ BLASTODERM

SH034 area pellucida (*n.*) (In reptiles and birds) the centre part of the blastoderm over the subgerminal cavity; its transparent appearance gives rise to the name. ↑ BLASTODERM

SH035 area opaca (*n.*) A marginal area surrounding the area pellucida; it lies over the yolk and appears less transparent than the area pellucida. ↑ BLASTODERM

SH036 area vasculosa (*n.*) A vascular region formed when a network of capillaries invades the area pellucida and the area opaca. ↑ BLASTODERM

SH037 primitive streak (*n.*) (In birds and mammals) two longitudinal folds of tissue in the blastoderm. Mesoderm moves from a superficial position to the interior of the blastoderm to form the primitive streak. ↓ PRIMITIVE GROOVE · PRIMITIVE NODE · PRIMITIVE KNOT ↑ BLASTULA

SH038 primitive groove (*n.*) The groove between the two ridges of the primitive streak. ↑ PRIMITIVE STREAK

SH039 primitive node (*n.*) An area in which the primitive streak begins; it consists of proliferating cells. ↑ PRIMITIVE STREAK

SH040 primitive knot (*n.*) Alternative term for PRIMITIVE NODE (↑).

SH041 blastocyst (*n.*) (In mammals) a stage of the embryo after the morula. A blastocyst consists of an embryonal knot inside a trophoblast. A blastocyst is a stage of embryonic development that corresponds approximately to that of a blastula. ↓ TROPHOBLAST · EMBRYONAL KNOT · PROAMNION ↑ BLASTULA

SH042 trophoblast (*n.*) The outer layer of cells which form the wall of the chorion. The trophoblast encloses a cavity in which the embryonal knot is situated at one pole of the trophoblast. The trophoblastic cells later help in the nourishment of the embryo. —***trophoblastic*** (*adj.*) ↑ BLASTOCYST → CHORION

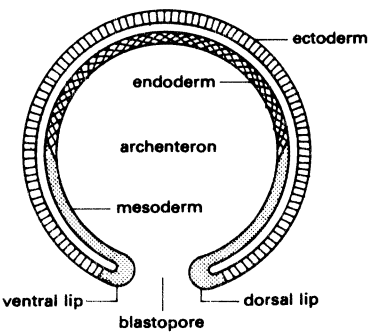
SH043 embryonal knot (*n.*) A mass of cells at one pole of a trophoblast; the future individual develops from this mass of cells. ↑ BLASTOCYST

SH044 proamnion (*n.*) (In higher vertebrates, such as birds and mammals) an area of the blastoderm in front of the neural plate into which mesoderm does not penetrate; it is composed only of ectoderm and endoderm. ↑ BLASTOCYST → NEURAL PLATE[1]

SH045 gastrula (*n.*) (In animals) a stage of the embryo after the blastula. Gastrulation takes place in the embryonic cells, and the gastrula is formed (see figure). —GASTRULATION (*n.*) ↓ GASTRULATION · ARCHENTERON · DETERMINATION[2] · ORGANIZER · PRESUMPTIVE · EPIBOLIC → ZYGOTE[2]

SH046 gastrulation (*n.*) (In almost all animals) the process of invagination of the cells of the blastula: the cells move to their presumptive regions. ↓ GERM LAYER · PRESUMPTIVE REGION · PRESUMPTIVE AREA ↑ GASTRULA

SH047 germ layer (*n.*) A recognizable group of cells in an embryo, distinguishable during, and immediately after, gastrulation. In diploblastic animals two germ layers develop, ectoderm and endoderm; triploblastic animals have a third germ layer, the mesoderm. In all animals there is a general similarity concerning which adult tissues develop from which germ layer, but there are many small differences in tissue development among the various groups of animals. ↑ GASTRULATION → ECTODERM · ENDODERM · MESODERM · DIPLOBLASTIC · TRIPLOBLASTIC



GASTRULA

SH048 presumptive region (*n.*) A part of an embryo consisting of cells which will develop into a germ layer and eventually into a particular tissue or organ. The presumptive regions of an embryo develop during gastrulation and may be recognizable before gastrulation occurs. ↑ GASTRULATION

SH049 presumptive area (*n.*) An alternative term for PRESUMPTIVE REGION (↑).

SH050 archenteron (*n.*) (In a gastrula) a cavity formed by the invagination of the mesodermal and endodermal germ layers. The cavity is connected to the exterior by an opening; the archenteron eventually develops into the gut of the animal. ↓ BLASTOPORE · DORSAL LIP · YOLK PLUG ↑ GASTRULA

SH051 blastopore (*n.*) A transitory opening on the surface of a gastrula; the archenteron communicates through it with the exterior. The blastopore is formed by invagination of the mesoderm and endoderm. In many animals the blastopore develops into the anus; in some animals it closes at the end of gastrulation. ↑ ARCHENTERON

SH052 dorsal lip (*n.*) (In the embryo of an amphibian) a part of the rim of the presumptive blastopore, initially it forms as a single curved line on the future dorsal side of the embryo. Development leads to the

extension of the lip so as to form a full circle, the rim of the blastopore. The blastopore is closed by a yolk plug. The dorsal lip is an **organizer.** ↓ ORGANIZER ↑ ARCHENTERON

SH053 yolk plug (*n.*) A mass of yolk cells which closes the blastopore in the gastrula of some animals. ↑ ARCHENTERON

SH054 determination[2] (*n.*) The process by which the development of the tissues and the future of the tissues is fixed, under any conditions of development at all, *i.e.* the embryonic tissues can form only one particular type of adult tissue or organ. —***determined*** (*adj.*) ↓ COMPETENCE · INDUCTION[2] · DEPENDENT DIFFERENTIATION · SELF-DIFFERENTIATION · MOSAIC DEVELOPMENT ↑ GASTRULA

SH055 competence (*n.*) The ability of an embryonic tissue to react to a stimulus which causes determination of the tissue. At the early stages of development, all embryonic tissues possess competence; when determination of the tissue occurs, the tissue loses its competence. —***competent*** (*adj.*) ↑ DETERMINATION[2]

SH056 induction[2] (*n.*) **1** A process in which a tissue or a cell influences neighbouring cells or tissues. **2** A process in which an embryonic tissue influences a neighbouring tissue and directs its differentiation. —INDUCTOR (*n.*) ↑ DETERMINATION[2]

SH057 dependent differentiation (*n.*) Differentiation in an embryonic tissue which depends upon a stimulus from another tissue or from an organizer. ↑ DETERMINATION[2]

SH058 self-differentiation (*n.*) Differentiation in a region or a tissue of an embryo which is independent of the influence of organizers or of other tissues. ↑ DETERMINATION[2]

SH059 mosaic development (*n.*) The development in an embryo after determination of tissues is completed, but before functional differentiation starts. Each region of the embryo differentiates separately and is almost independent of influence from other regions. The lack of dependence causes little regulation of the tissues by other organs. In vertebrates, mosaic development starts after gastrulation. In invertebrate groups with spiral cleavage, mosaic development occurs in zygotes or in early cleavage stages. ↑ DETERMINATION[2]

SH060 organizer (*n.*) Any part of an embryo which provides a stimulus for the development and differentiation of another part. Primary organizers provide the stimuli for the differentiation of tissues in embryos. Secondary organizers provide the stimuli for the development of detailed parts of organs and other structures in the later stages of development, *e.g.* the dorsal lip of a frog gastrula is a primary organizer for the cells near it. ↓ EVOCATOR · EVOCATION ↑ GASTRULA

SH061 evocator (*n.*) The chemical substance which is the stimulus provided by an organizer. The evocator usually has a lipoidal nature. ↑ ORGANIZER

SH062 evocation (*n.*) A biochemical process producing induced differentiation in an embryonic tissue. An evocator, a chemical substance, diffuses from a nearby tissue, or part of an embryo, and initiates the process. The evocator can also diffuse from an artificial implant. The focus is on the tissue producing the evocator. —EVOCATOR (*n.*) ↑ ORGANIZER

SH063 presumptive (*adj.*) Describes an embryonic tissue before differentiation has occurred; it means that in the normal course of development a particular type of tissue, or a particular organ, will be formed. ↑ GASTRULA

SH064 epibolic (*adj.*) Describes gastrulation in which the micromeres multiply quickly and grow down over the yolk-laden megameres; it is the characteristic gastrulation of eggs with plenty of yolk. ↓ EMBOLIC ↑ GASTRULA

SH065 emboliс (*adj.*) Describes gastrulation in which the endodermal germ layer pushes in, and a dorsal and a ventral lip are formed; the dorsal and ventral lips gradually move round, during development, to form the gastrula; this is the characteristic gastrulation of eggs with only a little yolk. ↑ EPIBOLIC

SH066 neurula (*n.*) (In vertebrates) the stage of development of an embryo after gastrulation has finished and before the neural tube is complete, *i.e.* it coincides with the formation of the neural tube. In this stage, determination of the germ layers is well advanced and differentiation of the tissues is proceeding rapidly. ↓ NOTOCHORD · SOMITIC MESODERM ↑ ZYGOTE[2] → NEURAL TUBE

SH067 notochord (*n.*) A rod consisting of large vacuolated cells packed in a firm sheath, with cell turgor maintaining the rigidity of the rod. The rod lies between a longitudinal nerve cord (or central nervous system) and the gut. In most vertebrates, the notochord is only complete in the embryo, being replaced by the backbone, or vertebral column, in the adult. It occurs in the larval forms of some vertebrates, such as tunicates, but is replaced by a backbone in the adult forms. The notochord is sufficient to support only the small adult bodies of primitive chordates, such as *Amphioxus.* ↓ CHORDA-MESODERM ↑ NEURULA

SH068 chorda-mesoderm (*n.*) An undifferentiated continuous mass of similar cells in an embryo; the cells give rise to mesoderm and notochord in more developed stages and they are closely related in their physiology of development. ↑ NOTOCHORD

SH069 somitic mesoderm (*n.*) Mesoderm on the ventral side of the embryo of a chordate; it consists of two longitudinal strips of tissue which lie on either side of the notochord. ↓ SOMITES · CRANIAL FLEXURE · CERVICAL FLEXURE ↑ NEURULA

SH070 somites (*n pl*) Somitic mesoderm

develops to form segments; these segments are somites. One ventral nerve root arises from, and a myotome is developed from, each somite; the segmented vertebral column arises from the somites. Mesenchyme is also formed from somites and it develops into connective tissue. ↑ SOMITIC MESODERM → NERVE ROOT · MYOTOME · MESENCHYME

SH071 cranial flexure (*n.*) The foremost somites in the head region of the embryo become bent downwards towards the ventral side; this forms the cranial flexure. ↑ SOMITIC MESODERM

SH072 cervical flexure (*n.*) Somites in the anterior part of the embryo bend in the opposite direction to the cranial flexure; this is the cervical flexure. The two flexures give the embryo the shape of a question mark (?). ↑ SOMITIC MESODERM

SH073 embryonic membranes (*n.pl.*) Membranes derived from the zygote but lying outside the embryo itself. The membranes are the amnion, chorion, yolk-sac, and allantois; they take part in the protection, nutrition, and respiration of the embryo. ↓ EXTRA-EMBRYONIC MEMBRANES · ALLANTOIS · ALLANTOIC ↑ ZYGOTE[2]

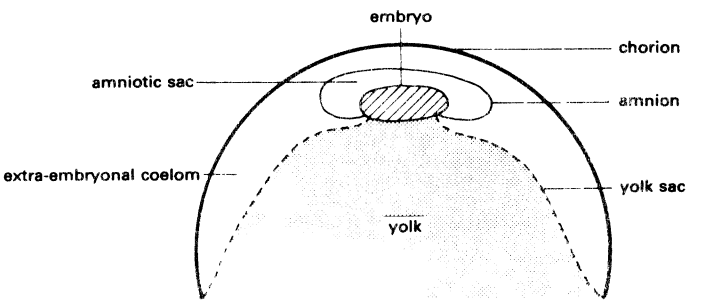
SH074 extra-embryonic membranes (*n.pl.*) Alternative term for EMBRYONIC MEMBRANES. The term is used to emphasize the fact that the membranes develop outside the foetus. ↓ CHORION · AMNION · AMNIOTIC FLUID ↑ EMBRYONIC MEMBRANES

SH075 chorion (*n.*) **1** An embryonic membrane which grows to enclose the embryo; it consists of an outer layer of ectoderm and an inner layer of mesoderm, *e.g.* ***a*** in reptiles and birds, it forms the outer of two layers enclosing the amniotic sac; ***b*** in mammals, it is a membrane enclosing all the structures of the embryo; its outer layer is the trophoblast; the placenta is formed from the chorion. **2** The outer covering of an insect egg, secreted by cells in the ovary. ↑ EXTRA-EMBRYONIC MEMBRANES

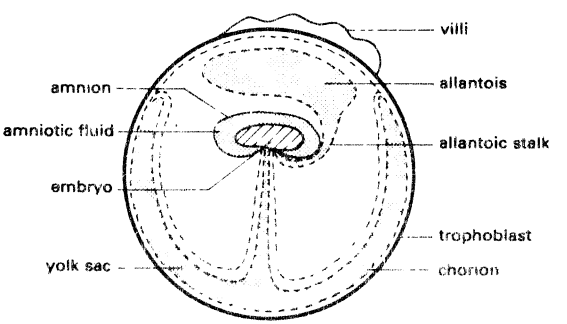
SH076 amnion (*n.*) (In reptiles, birds, and mammals) a membrane which grows to enclose a developing embryo. It is the inner layer of a liquid-containing sac; the outer layer is the chorion and between the two layers is a space, the extra-embryonal coelom. The amnion encloses an amniotic sac. —***amniote*** (*n.*) ***amniotic*** (*adj.*) ↑ EXTRA-EMBRYONIC MEMBRANES

SH077 amniotic fluid (*n.*) The liquid contained in an amniotic sac; it provides a liquid environment for the developing embryo and also protects the embryo from external jarring. In mammals it protects the embryo from being deformed by pressure from the maternal organs. ↑ EXTRA-EMBRYONIC MEMBRANES

SH078 allantois (*n.*) A membranous sac which grows from the ventral side of an embryo. It grows to extend outside the embryo, with a different development in different species of amniotes, but in all it is



CHORION (REPTILE AND BIRD)



CHORION (MAMMAL)

richly supplied with blood vessels. *E.g.* ***a*** In reptiles and birds the allantois grows into the extra-embryonal coelom until it occupies the greater part of the space; it presses against the chorion and eventually against the inside of the shell and its membrane. Respiration takes place by gaseous exchange through the porous shell and the gases are transported by the allantoic blood vessels. Excretory products from the embryo are stored in the allantois. ***b*** In placental mammals, the allantois connects with the placenta and the allantoic blood vessels supply blood to the placenta. Embryonic nutrition, respiration, and excretion, take place through these blood vessels. The sac encloses a cavity which may in some mammals store urine from the embryo, but the amount is small. —ALLANTOIC (*adj.*) ↓ YOLK SAC · YOLK STALK · VITELLINE BLOOD VESSELS ↑ EMBRYONIC MEMBRANES → URICOTELIC · UREOTELIC

SH079 yolk sac (*n.*) A membranous sac attached to the ventral surface of an embryo of some vertebrates, *e.g.* some bony and cartilaginous fishes, reptiles, and birds. The yolk sac communicates with the intestines of the embryo; its contents are gradually absorbed as a food supply, and the yolk sac is withdrawn until it merges into the embryo. ↑ ALLANTOIS

SH080 yolk stalk (*n.*) A short tube containing ducts and connecting the embryo with the yolk sac. ↑ ALLANTOIS

SH081 vitelline blood vessels (*n.pl.*) Arteries and veins passing through the yolk stalk from an embryo and covering the yolk sac. ↑ ALLANTOIS

SH082 allantoic (*adj.*) Of or to do with the allantois. ↑ EMBRYONIC MEMBRANES

SH083 egg (*n.*) **1** A structure composed of an ovum, and any necessary materials needed for its development and its protection, such as membranes or shell, if it is fertilized; eggs are produced by birds, reptiles, and amphibia. **2** The fertilized ovum of any animal, usually covered with a protective casing; it may be carried by the female or be deposited; after a period of time it hatches and an offspring emerges □ *offspring hatch out of an egg; eggs are laid by a female animal* ↓ SHELL[3] · INCUBATION[1] · POLYSPERMY · ANIMAL POLE · EGG MEMBRANES · LAY · CENTROLECITHAL · VITELLINE ↑ ZYGOTE[2]

SH084 shell[3] (*n.*) (In terrestrial oviparous animals) the thin, hard, outer protective covering of the egg, usually calcareous, horny, or chitinous; it is porous to gases but impervious to liquids. The shell is secreted by the shell gland in the oviduct. ↓ SHELL MEMBRANE · YOLK[1] · ALBUMEN · CHALAZA · EGG-WHITE ↑ EGG → OVIPAROUS · CALCAREOUS · CHITINOUS

SH085 shell membrane (*n.*) A double membrane which is tough and leathery, situated immediately beneath the shell of an egg. In birds' eggs the two layers are separated to form an air cavity at one end of the egg. The shell membrane is secreted by a gland in the oviduct. ↑ SHELL[3] → OVIDUCT

SH086 yolk[1] (*n.*) A store of food material for the use of an embryo in an egg. It consists of protein and fat granules and occurs in the eggs of the majority of animals. In a bird's egg, it is coloured yellow and situated in the middle of the egg. Eggs vary considerably in the amount of yolk and its distribution in the egg. —YOLKY (*adj.*) ↑ SHELL[3]

SH087 albumen (*n.*) (In birds and reptiles) a solution of protein in water, situated between the yolk and the egg shell, surrounding the yolk; also called ***egg-white***. It is secreted by glands in the oviduct and absorbed as food material by the embryo. —***albuminous*** (*adj.*) ↑ SHELL[3]

SH088 chalaza[2] (*n.,pl.* **chalazae**) A twisted cord of coagulated albumen connecting the ovum of a bird's egg to the shell membrane; there are two chalazae, one on each side of the ovum, and they anchor the ovum in its place, surrounded by albumen. ↑ SHELL[3]

SH089 egg-white (*n.*) Alternative term for ALBUMEN (↑).

SH090 incubation[1] (*n.*) The process of incubating eggs. ↓ INCUBATION PERIOD · INCUBATOR · CLUTCH · INCUBATE ↑ EGG

SH091 incubation period (*n.*) The period of time between the laying of an egg and the hatching of young. ↑ INCUBATION[1]

SH092 incubator (*n.*) An apparatus supplying heat for the incubation of eggs; usually used with hens' eggs. ↑ INCUBATION[1]

SH093 clutch (*n.*) A number of eggs which are all being incubated at the same time by a parent, or by the sun's warmth. ↑ INCUBATION[1]

SH094 polyspermy (*n.*) The penetration of more than one spermatozoon into one ovum; only one sperm nucleus fuses with the nucleus of the ovum, the remaining spermatozoa take little part in the subsequent development of the fertilized ovum. It occurs in very yolky eggs, such as birds' eggs, and it may occur in other eggs in abnormal conditions; it then upsets further development ↑ EGG

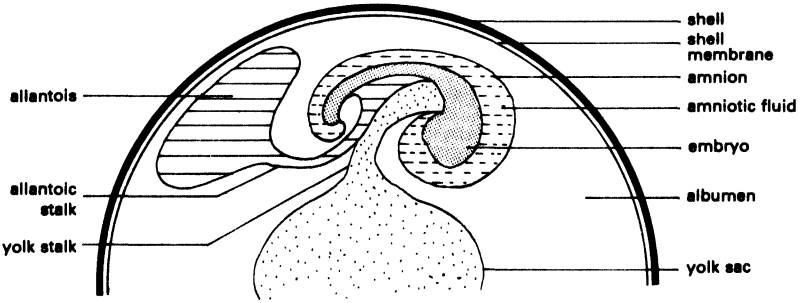
SH095 animal pole (*n.*) **1** The point on the surface of a telolecithal egg nearest to its nucleus. The part of the egg nearest the animal pole contains less yolk. **2** The side of a blastula, at which micromeres are formed. ↓ VEGETAL POLE (P) · VEGETATIVE POLE · MOSAIC EGG ↑ EGG → TELOLECITHAL

SH096 vegetal pole (*n.*) **1** The point on the surface of a telolecithal egg furthest from its nucleus. The part of the egg nearest the vegetal pole contains most of the yolk. **2** The side of a blastula at which megameres collect. ↑ ANIMAL POLE (P)

SH097 vegetative pole (*n.*) Alternative term for VEGETAL POLE (↑). ↑ ANIMAL POLE

SH098 mosaic egg (*n.*) A fertilized egg exhibiting mosaic development in the zygote or early cleavage stages. ↑ ANIMAL POLE → MOSAIC DEVELOPMENT

SH099 egg membranes (*n.pl.*) (In animals) membranes which surround and protect the egg, eggs of terrestrial animals usually have



EGG EMBRYONIC MEMBRANES

well-developed membranes. The membranes are grouped according to their origin, *a* membranes secreted by the ovum itself, such as vitelline membrane; *b* membranes secreted by other cells in the ovary, such as chorion of insect eggs; *c* membranes secreted by specialized cells in the oviduct, such as the outer shell of a bird's egg or the jelly of an amphibian's egg. ↓ VITELLINE MEMBRANE ↑ EGG

SH100 vitelline membrane (*n.*) A tough membrane which after fertilization covers the ovum in many cases; it is secreted by the ovum. ↑ EGG MEMBRANES

SH101 lay (*v.t.*) (*p.t., p.p.* **laid**) (Of arthropods, reptiles, and birds) to produce eggs, especially in a nest. Compare aquatic animals which **shed** eggs. ↓ HATCH · INCUBATE ↑ EGG

SH102 hatch (*v.t.,i.*) **1** (*v.i.*) (Of a fully formed individual, developed from an embryo in an egg) to start to breathe air and break out of the shell of a cleidoic egg, or break through the surrounding membrane of an aquatic egg, or of an egg in water, *e.g. a* chicks hatch out of hens' eggs; *b* mosquito larvae hatch out of mosquito eggs. **2** (*v.t.*) To cause a young bird to hatch in this way. **3** (*v.i.*) (Of an egg) to break, allowing a fully formed embryo to come out, *e.g.* eggs hatch by means of heat. **4** (*v.t.*) To cause an egg to break in this way, *e.g.* the heat of a hen's body hatches the eggs. ↑ LAY

SH103 incubate (*v.t.*) To cause fertilized eggs to develop, by means of carefully controlled heat, until they hatch. The heat is provided by the body heat of a parent, or by the sun, or by artificial means, as in an incubator □ *a hen incubates a clutch of eggs by sitting on them* —INCUBATION, INCUBATOR (*n.*) ↑ LAY

SH104 centrolecithal (*adj.*) Describes an ovum with the yolk granules massed in the centre of the egg substance. ↓ TELOLECITHAL · ISOLECITHAL · MICROLECITHAL · MEGALECITHAL · MESOLECITHAL · MACROLECITHAL · POLYLECITHAL ↑ EGG

SH105 telolecithal (*adj.*) Describes an ovum with the yolk granules accumulated in one hemisphere of the egg substance. ↑ CENTROLECITHAL

SH106 isolecithal (*adj.*) Describes an ovum with the yolk granules distributed equally throughout the egg substance. ↑ CENTROLECITHAL

SH107 microlecithal (*adj.*) Describes an ovum with only a little yolk. Microlecithal ova are laid in great numbers. ↓ MEGALECITHAL (An) · MACROLECITHAL (An) · POLYLECITHAL (An) ↑ CENTROLECITHAL

SH108 megalecithal (*adj.*) Describes an ovum containing a relatively large amount of yolk, *e.g.* as in the centrolecithal eggs of reptiles and birds. Only a few megalecithal eggs are laid and the young animal is more mature when hatched than the young from microlecithal eggs. ↑ CENTROLECITHAL · MICROLECITHAL (An)

SH109 mesolecithal (*adj.*) Describes an ovum with a moderate amount of yolk. ↑ CENTROLECITHAL

SH110 macrolecithal (*adj.*) Alternative term for MEGALECITHAL (↑).

SH111 polylecithal (*adj.*) Alternative term for MEGALECITHAL (↑).

SH112 vitelline (*adj.*) Of or to do with yolk or a yolk-producing organ. ↓ CLEIDOIC · YOLKY ↑ EGG

SH113 cleidoic (*adj.*) Describes an egg enclosed in a shell or other hard protective membrane; the term is applied to the eggs of terrestrial animals, *e.g.* birds, reptiles, insects. Such eggs are isolated from their surroundings by the shell and only gases can be exchanged with the surroundings; occasionally some water may be lost as vapour Compare aquatic eggs, in which water and solutes are freely exchanged with the surroundings. ↑ VITELLINE → MARINE (An)

SH114 yolky (*adj.*) Describes an egg containing a lot of yolk. ↑ VITELLINE

Mammalian Embryology

SJ001 placenta[1] (*n.*) A vascular, spongy, double structure formed from maternal tissues (endometrium) and embryonic tissues (chorion) in viviparous mammals; the two tissues interdigitate to bring the vascular systems of mother and embryo in close proximity, while keeping the two systems separate. The vascular system of the embryo is connected to the placenta by blood vessels in the allantois, and in some cases, blood vessels in the yolk sac. The function of the placenta is to allow the exchange of nutritive and respiratory substances between mother and embryo. It also produces gonadotrophic hormones. In ungulates, the trophoblast of the chorion is in close contact with the uterine wall which does not form a decidua; the allantoic placenta is in close contact with the chorion. In placental animals with deciduate placentation, the endometrium of the uterus undergoes considerable alteration and is in parts eroded. The trophoblast of the chorion is in contact with either the maternal blood vessels or with the maternal blood. —PLACENTAL, PLACENTATE (*adj.*) PLACENTATION (*n.*) ↓ PLACENTATION[1] · ENDOMETRIUM · UMBILICUS · FOETUS · GESTATION · PARTURITION · BEAR · PLACENTAL · PREGNANT · MONOZYGOTIC → ZYGOTE[1] · TROPHOBLAST · ALLANTOIS

SJ002 placentation[1] (*n.*) The manner in which the placenta is formed; its structural type. ↑ PLACENTA[1]

SJ003 endometrium (*n.*) The glandular mucous membrane lining the uterus of mammals. During the oestrous cycle it first undergoes growth, preparing for pregnancy, and then destruction, leading to menstruation. ↓ DECIDUA · CRYPTS · AFTERBIRTH · CAUL[1] ↑ PLACENTA[1]

SJ004 decidua (*n.*) In placental mammals other than ungulates the endometrium of the uterus becomes thickened and highly vascular during pregnancy and forms a decidua. This tissue forms the maternal portion of the placenta; it is so firmly interlocked with the embryonic tissue of the placenta that some or all of the decidua is shed at birth. —DECIDUATE (*adj.*) ↑ ENDOMETRIUM

SJ005 crypts (*n.pl.*) Depressions in the spongy, vascular tissues of the wall of a uterus. Villi from a placenta grow into the crypts by destruction of the uterine lining. ↑ ENDOMETRIUM → VILLUS · UTERUS

SJ006 afterbirth (*n.*) The placenta and decidua shed after the birth of a baby mammal. ↑ ENDOMETRIUM

SJ007 caul[1] (*n.*) During parturition the amnion may not rupture completely and the offspring is born enclosed in the amnion. This bag round the offspring is a caul. ↑ ENDOMETRIUM → AMNION

SJ008 umbilicus (*n.*) A depression in the abdomen of mammals at the place of attachment of the umbilical cord. —UMBILICAL (*adj.*) ↓ UMBILICAL CORD · UMBILICAL VESICLE · UMBILICAL STALK · NAVEL ↑ PLACENTA[2]

SJ009 umbilical cord (*n.*) A stalk or cord from the ventral surface of an embryo connecting it to the placenta. It consists of the stalks of the allantois and of the yolk sac; it is mainly mesoderm containing the blood vessels of the allantois and yolk sac. The umbilical cord is surrounded by the amniotic fluid; it usually breaks or is broken by the mother at birth. ↑ UMBILICUS → ALLANTOIS

SJ010 umbilical vesicle (*n.*) The yolk sac of placental mammals; the size varies in different species. It is a functionless vestige, as there is no yolk to provide nourishment for the developing embryo. ↑ UMBILICUS → YOLK SAC

SJ011 umbilical stalk (*n.*) Alternative term for UMBILICAL CORD (↑).

SJ012 navel (*n.*) Alternative term for UMBILICUS (↑).

SJ013 foetus (*n.*) The embryo of a mammal after the main features have developed sufficiently to be recognizable; in man, this is after about 6-8 weeks. —FOETAL (*adj.*) ↓ FOETAL MEMBRANES · IMPLANTATION · NIDATION ↑ PLACENTA[1]

SJ014 foetal membranes (*n.pl.*) The embryonic membranes of a mammalian foetus. ↑ FOETUS

SJ015 implantation (*n.*) (In mammals) the attachment of the blastocyst to the endometrium of the uterus before the formation of the placenta. In primates, the blastocyst dissolves a part of the endometrium and embeds itself in the wall of the uterus. ↑ FOETUS

SJ016 nidation (*n.*) Alternative term for IMPLANTATION (↑). ↑ FOETUS

SJ017 gestation (*n.*) The process of development of a mammalian embryo in its mother's uterus. —***gestate*** (*v.*) ↓ GESTATION PERIOD · PREGNANCY ↑ PLACENTA[1]

SJ018 gestation period (*n.*) (Of a viviparous mammal) the length of time between conception and birth. ↑ GESTATION → CONCEPTION

SJ019 pregnancy (*n.*) The condition of being pregnant □ *towards the end of pregnancy a female rabbit starts to build a nest for her offspring* ↑ GESTATION ↓ ABORTION

SJ020 abortion (*n.*) The birth of a mammalian foetus before gestation is completed and before the offspring is capable of separate existence. Natural abortion occurs if the foetus dies or if it is rejected for other reasons. Abortion can be induced artificially. —***abort*** (*v.*) ↑ GESTATION

SJ021 parturition (*n.*) The process of birth in a mammal. The amnion and chorion rupture, periodic contractions of the uterine muscles occur, and the foetus passes down

the vagina, head first. ↓ BIRTH · LITTER · SIBLING ↑ PLACENTA[1]

SJ022 birth (*n.*) The bringing forth of offspring from within a mother's body; the term is general and is applied to viviparous and ovoviviparous animals, *e.g.* ***a*** the birth of a litter of rabbits with the accompanying discharge of placenta and decidua. ***b*** The birth of a dogfish: in this animal, which is ovoviviparous, the eggs develop in the mother's uterus (a gestation period of 16 to 25 months), but no nourishment is supplied by the mother's vascular system and no placenta is formed; the mother gives birth to young dogfish when they are sufficiently developed. ↑ PARTURITION (H)

SJ023 litter (*n.*) The group of offspring produced by a mammal at one birth. If a cat gives birth to six kittens in one parturition, the six kittens form a litter. ↑ PARTURITION

SJ024 sibling (*n.*) One of the brothers and/or sisters reproduced by the same male parent and the same female parent, but not at the same birth. ↑ PARTURITION → OFFSPRING

SJ025 bear (*v.t.*) **1** (*p.t.* **bore** *p.p.* **born**) To give birth to offspring; the focus is usually on the offspring with the verb found in the past tense passive, *e.g.* ***a*** the rabbits were born yesterday (compare *the mother gave birth to the rabbits yesterday*); ***b*** the child is not expected to be born until tomorrow □ *all three children were born of the same mother* **2** (*p.t.* **bore** *p.p.* **borne**) To carry offspring during pregnancy, *e.g.* ***a*** a woman bears a child for 9 months; ***b*** the cat had never borne kittens, *i.e.* it had never been pregnant. The focus is on the mother □ *all three litters were borne by the same cat* —BEARING (*n.*) ↓ WEAN ↑ PLACENTA[1]

SJ026 wean (*v.t.*) To replace a mother's milk with solid food in a young mammal's diet. To accustom a young mammal's diet to solid food after its mother's milk, *e.g.* a human baby is weaned gradually as its mother's milk dries up ↑ BEAR

SJ027 placental (*adj.*) Of or to do with a placenta. ↓ PLACENTATE · DECIDUATE · NON-DECIDUATE · DISCOIDAL[2] · METADISCOIDAL · ZONARY[2] ↑ PLACENTA[2]

SJ028 placentate (*adj.*) Having a placenta developed, *e.g.* the placentate uterine wall in a pregnant female mammal. ↑ PLACENTAL

SJ029 deciduate (*adj.*) Describes the type of placenta in contact with a decidua. ↓ NON-DECIDUATE (An) ↑ DECIDUA · PLACENTAL

SJ030 non-deciduate (*adj.*) Describes the type of placenta without a decidua, as found in ungulates. ↑ PLACENTAL · DECIDUATE (An)

SJ031 discoidal[2] (*adj.*) Describes a small disc-shaped placenta attached to the uterus on the dorsal side of an embryo, *e.g.* as in rabbits. ↑ PLACENTAL

SJ032 metadiscoidal (*adj.*) Describes a placenta in which villi are scattered when the placenta is formed, but the villi finally form a disc on the uterine wall on the ventral side of the embryo, *e.g.* as in man and primates. ↑ PLACENTAL

SJ033 zonary[2] (*adj.*) Describes a placenta in which the villi form a band in the uterine wall arranged in a girdle around the embryo, *e.g.* as in carnivores. ↑ PLACENTAL

SJ034 pregnant (*adj.*) Describes a female mammal with an embryo developing in the uterus. ↓ FOETAL · UMBILICAL ↑ PLACENTA[1]

SJ035 foetal (*adj.*) Of or to do with a foetus. ↑ PREGNANT

SJ036 umbilical (*adj.*) Of or to do with the umbilicus or the umbilical cord. ↑ PREGNANT

SJ037 monozygotic (*adj.*) Describes embryos or individuals developing from one fertilized ovum, *e.g.* identical twins are monozygotic twins, as they are formed from one fertilized ovum; at some stage of development the embryo formed from the fertilized ovum underwent fission into two. Monozygotic twins are genetically identical. ↓ DIZYGOTIC · UNIOVULAR ↑ PLACENTA[1]

SJ038 dizygotic (*adj.*) Describes embryos or individuals developing from two separate ova fertilized simultaneously, *e.g.* fraternal twins are dizygotic twins. Fraternal twins are not identical; they are no more alike than other siblings of the parents. ↑ MONOZYGOTIC · SIBLING

SJ039 uniovular (*adj.*) Alternative term for MONOZYGOTIC (↑).

Heredity

TA001 heredity (*n.*) The disposition to transmit qualities and characteristics of living things from one generation to successive generations of the same species. The gene is the unit of transmission of such qualities and characteristics. —HEREDITABILITY (*n.*) INHERIT (*v.*) HEREDITARY. ***hereditable*** (*adj.*) ↓ PEDIGREE · QUALITATIVE INHERITANCE · INHERIT · HEREDITARY · DORMANT[2] · VARIATION[2] → NUCLEIC ACID GENE · REPRODUCTION · OFFSPRING · PARENT

TA002 pedigree (*n.*) A table which shows the relationship, through descent, of living organisms. The table can show the ancestors of a particular organism, or the progeny of a pair of organisms, or the relationship between individuals in successive generations. For biological purposes, a pedigree is usually a visual record, in the form of a table, of the distribution of one or more traits or characteristics in different generations of related individuals, *e.g.* a table of related

human beings, showing which ones are colour blind, can help to establish the mechanism by which colour blindness is inherited. ↓ GENERATION[2] · INHERITANCE · HEREDITABILITY ↑ HEREDITY

TA003 generation[2] (*n.*) One level in a pedigree; the term describes, ***a*** all the offspring from a pair of parents; ***b*** all the cells produced from a selected cell after the same number of divisions □ *the first generation of hybrids possesses only dominant characteristics, but the second generation possesses both dominant and recessive characteristics* ↑ PEDIGREE → REPRODUCTION

TA004 inheritance (*n.*) The sum of qualities and characteristics, whether overt or dormant, inherited from a parent or parents by the offspring. ↑ PEDIGREE

TA005 hereditability (*n.*) The ability to be part of heredity, *e.g.* ***a*** the differing hereditability of haemophilia in males and females; ***b*** the hereditability of colour-blindness is much higher in males than in females for human beings. ↑ PEDIGREE

TA006 qualitative inheritance (*n.*) Inheritance of a particular characteristic, such as sex, in which the trait differs sharply amongst individuals of a species. Such inheritance depends upon a few genes. ↓ QUANTITATIVE INHERITANCE · DISCONTINUOUS VARIATION (Cs) ↑ HEREDITY

TA007 quantitative inheritance (*n.*) Inheritance of a particular characteristic, such as height or weight, in which the trait differs only in degree amongst individuals. Such inheritance depends on the associated action of a number of genes, each of which produces a small effect. ↓ CONTINUOUS VARIATION (Cs) ↑ QUALITATIVE INHERITANCE

TA008 inherit (*v.t.*) To receive qualities and characteristics transmitted from parents by means of reproduction, and consequently from previous generations, *i.e.* from ancestors, *e.g.* to inherit brown eyes, long-sightedness, haemophilia, colour blindness. —INHERITANCE (*n.*) INHERITED (*adj.*) ↑ HEREDITY

TA009 hereditary (*adj.*) Describes a quality or characteristic, either overt or dormant, that can be transmitted from one generation to succeeding generations, *e.g.* ***a*** hereditary diseases such as haemophilia; ***b*** hereditary characteristics such as the colour of the eyes. ↓ HEREDITABLE · INHERITED · HERITABLE

TA010 hereditable (*adj.*) Describes a quality or characteristic that can be transmitted by heredity, as opposed to a characteristic acquired during life. ↑ HEREDITARY

TA011 inherited (*adj.*) Describes an observable quality or characteristic acquired through heredity. Compare **hereditary** and **inherited**: colour blindness is an hereditary characteristic, but the inherited characteristic is rarer amongst females than amongst males. ↑ HEREDITARY

TA012 heritable (*adj.*) Alternative term for HEREDITABLE (↑) —***heritability*** (*n.*)

TA013 dormant[2] (*adj.*) Describes an inherited quality or characteristic that is not observable, but is transmitted to future generations, *e.g.* the characteristic of colour blindness can be dormant in a mother and appear in her son. ↓ OVERT ↑ HEREDITARY

TA014 overt (*adj.*) Describes a quality or characteristic that is both transmitted and observable, *e.g.* a colour-blind man has the overt characteristic of colour blindness. ↑ DORMANT[2] (I)

TA015 variation[2] (*n.*) The differences between individuals, either plants or animals, of the same species. The variations between individuals may be due to difference in the genes of the individuals or difference in environment during development. In plants, examples of variation are found in colour of flowers, size and appearance of seeds, height of plant, or size of fruit. In animals, examples of variation are found in size or development, colour of hair, or colour of eyes. ↓ TRAIT · PURE STRAIN · HYBRID · HYBRIDISM · CONTINUOUS VARIATION · VARY[3] · MENDELISM ↑ HEREDITY → GENETICS · SPECIES[1] · CHARACTERISTICS

TA016 trait (*n.*) An item chosen from a list of characteristics of an organism for a particular study. Varieties of plant species or breeds, or strains of animal species, can be differentiated by particular traits, which are outstanding characteristics, *e.g.* a species of plant can have smooth seeds or wrinkled seeds; these are different traits. The remaining characteristics of the plant are sufficiently alike for the plants to be identified as belonging to the same species. Traits serve to differentiate varieties within species, or individuals within species. ↓ WILD TYPE · VARIANT · SPORT · ROGUE · RECOMBINATION ↑ VARIATION[2] → CHARACTERISTICS

TA017 wild type (*n.*) The typical phenotype of the majority of individuals of a species, as found in natural conditions. ↑ TRAIT → MUTANT[1] (An) · PHENOTYPE

TA018 variant (*n.*) An individual plant or animal that is different from the remainder of the species. ↑ TRAIT

TA019 sport (*n.*) An individual, or part of an individual, differing from normal in a marked fashion, *e.g.* a bud sport. Sports arise from genetic changes in the body cells (somatic mutations). ↑ TRAIT → MUTATION

TA020 rogue (*n.*) A plant differing from other specimens of the same species or variety around it because of mutation. ↑ TRAIT

TA021 recombination (*n.*) The occurrence in offspring of combinations of genes not present in either parent, caused by the random pairing of chromosomes and their associated genes during meiosis. The characteristics thus produced make the offspring different from either parent. ↑ TRAIT

TA022 pure strain (*n.*) Successive generations of an organism, obtained by inbreeding, so that the organisms are homozygous for all genes. The organisms always breed true, *i.e.* they always possess

the same inherited qualities and characteristics. Self-fertilization is the most suitable method of in-breeding to obtain pure strains of plants. ↓ F_1 · F_2 · PURE LINE · HYBRID (I) · MULE (I) ↑ VARIATION[2] → INBREEDING · HOMOZYGOUS

TA023 F_1 (*abbr.*) The first filial generation of offspring resulting from crossing organisms of a parental generation. An experiment on crossing plants or animals starts with a known parental generation. ↑ PURE STRAIN

TA024 F_2 (*abbr.*) The second filial generation of offspring resulting from crossing the members of the F_1 generation. ↑ PURE STRAIN

TA025 pure line (*n.*) Alternative term for PURE STRAIN. ↑ PURE STRAIN

TA026 hybrid (*n.*) An organism produced by sexual reproduction from parents that are genetically different. If the parents have only one different trait, the offspring are monohybrids, and are heterozygous for the gene responsible for the trait. If the parents differ in two traits, the offspring are dihybrids. A hybrid is produced by cross-breeding two pure strains of organisms. If the genetical relationship between parents is distant, the hybrid offspring tend to be sterile. —***hybridization***, HYBRIDISM, ***hybridity*** (*n.*) ***hybridize*** (*v.*) ***hybridizable*** (*adj.*) ↓ MONOHYBRID · DIHYBRID · CROSS[1] · CRISS-CROSS · MULE (H) ↑ PURE STRAIN (I)

TA027 monohybrid (*n.*) See HYBRID. —***monohybridism*** (*n.*) ↑ HYBRID

TA028 dihybrid (*n.*) See HYBRID. —***dihybridism*** (*n.*) ↑ HYBRID

TA029 cross[1] (*n.*) The offspring from crossing two organisms of different breeds or varieties, not necessarily pure strains. ↑ HYBRID

TA030 criss-cross (*n.*) A type of inheritance in which offspring of one sex resemble the parent of the opposite sex ↑ HYBRID

TA031 mule (*n.*) **1** The offspring of a male donkey and a female horse. Compare a **hinny** which is the offspring of a male horse and a female donkey. ↑ HYBRID

TA032 hybridism (*n.*) The state of being a hybrid, *e.g.* a mule exhibits hybridism. ↓ ATAVISM ↑ VARIATION[2]

TA033 atavism (*n.*) The recurrence of characteristics in an individual inherited from an ancestor after an interval of several generations, during which time the characteristics have not been manifested. —***atavistic*** (*adj.*) ↑ HYBRIDISM

TA034 continuous variation (*n.*) The distribution of traits from quantitative inheritance, *i.e.* the traits show every gradation from one extreme to the other, with the greater part of the population being of intermediate types, *e.g.* as in the case of height. ↓ DISCONTINUOUS VARIATION ↑ QUANTITATIVE INHERITANCE · VARIATION[2]

TA035 discontinuous variation (*n.*) The distribution of traits from qualitative inheritance. ↑ QUALITATIVE INHERITANCE · CONTINUOUS VARIATION

TA036 vary[3] (*v.i.*) To be different; to have characteristics that are not the same as each other; individuals of the same species are never exactly alike, their individual characteristics vary □ *individuals* vary in *characteristics* —VARIATION, VARIANT, VARIETY, ***variegation*** (*n.*) ***varied***, VARIABLE, ***variegated*** (*adj.*) ↓ CROSS[2] · HYBRIDIZE ↑ VARIATION[2]

TA037 cross[2] (*v.t.*) To mate two organisms, of different animal breeds or plant varieties, intentionally to produce certain offspring. ↓ HYBRIDIZE (Sn) ↑ VARY[3] → BREED (H)

TA038 hybridize (*v.t.,i.*) To produce hybrids by interbreeding or by crossing. ↑ VARY[3] · HYBRID

TA039 Mendelism (*n.*) The manner of operation of Mendel's laws. ↓ MENDEL'S LAWS · MENDELIAN ↑ VARIATION[2]

TA040 Mendel's laws (*n.pl.*) The first Law of Segregation and the second Law of Independent Assortment. Segregation and independent assortment apply to alleles passed on from parents to offspring and give rise to variation in the genetic composition of individuals. In Mendel's original work he referred to heritable factors; these are now accepted as genes. ↑ MENDELISM → ALLELE · SEGREGATION

TA041 Mendelian factor (*n.*) A unit responsible for a characteristic in an individual, *e.g.* when pure strains of tall peas and dwarf peas are crossed, each parent plant contributes a factor of tallness or shortness to the offspring. A Mendelian factor can be dominant or recessive, and such a factor corresponds to a gene. ↑ MENDEL'S LAWS → GENE

TA042 Mendelian (*adj.*) Describes a trait or characteristic which behaves in accordance with Mendel's laws ↑ MENDELISM

Nucleic Functions

TB001 nucleic acid (*n.*) A long-chain chemical compound formed from many nucleotides bonded together. There are two forms of nucleic acid deoxyribose nucleic acid (DNA) and ribose nucleic acid (RNA). Both forms are found in all the cells of all living organisms. ↓ NUCLEOTIDE · RIBONUCLEIC ACID · TRANSCRIPTION → HEREDITY

TB002 nucleotide (*n.*) A unit in a long chain molecule of nucleic acid. It is a chemical compound formed from one molecule of a sugar (ribose or deoxyribose), one molecule

of phosphoric acid, and one molecule of a base (containing an amino group). Nucleotides are also found free in cells. ↓ DNA · RNA · NUCLEOTIDE PAIRS · MUTON · DOUBLE HELIX · MESSENGER RNA · TRANSFER RNA ↑ NUCLEIC ACID

TB003 DNA (*abbr.*) A long chain compound formed from many nucleotides bonded together as units in the chain. A strand of DNA is formed from molecules of deoxyribose (a sugar) and molecules of phosphoric acid attached alternately in a chain. Attached to each sugar molecule is a base which is one of four: adenine, thyamine, cytosine, and guanine. Usually two strands are coiled round each other in the form of a double helix, with the strands connected to each other through a pair of bases. The bases can only be paired in two ways. Adenine pairs with thyamine, and cytosine pairs with guanine. By convention, one strand is called positive and the other is called negative. The strands can be separated by heat. DNA is found only in the chromosomes of plants and animals and the corresponding structures in bacteria and viruses. DNA is the abbreviation of deoxyribonucleic acid. ↓ RNA ↑ NUCLEOTIDE

TB004 RNA (*abbr.*) A long chain chemical compound formed from many nucleotides bonded together as units in the chain. A strand of RNA is formed from molecules of ribose (a sugar) and molecules of phosphoric acid attached alternately in a chain. Attached to each sugar molecule is one of four bases: adenine, uracil, cytosine, and guanine. A molecule of RNA consists of one strand. RNA is found in the nuclei, the ribosomes, and the cytoplasm, of all cells of all organisms. RNA is the abbreviation for ribonucleic acid. ↑ NUCLEOTIDE → RIBOSOME · RIBONUCLEASE

TB005 nucleotide pairs (*n.pl.*) Two nucleotides, each on a different strand of DNA, joined by chemical bonds between their bases. The nucleotides only pair with the combination of, ***a*** the bases adenine and thyamine or, ***b*** cytosine and guanine. ↑ NUCLEOTIDE

TB006 muton (*n.*) The smallest unit of DNA in a gene, which when changed can cause a mutation. The muton is one to three nucleotide pairs. ↑ NUCLEOTIDE

TB007 double helix (*n.*) Two helices of equal diameter, turning in opposite directions; in DNA the helices are connected across a diameter by chemical bonds between two nucleotides. ↑ NUCLEOTIDE → HELIX

TB008 messenger RNA (*n.*) A single strand of RNA produced from a length of DNA (a cistron) by the enzyme transcriptase. A molecule of messenger RNA contains the genetic code to be translated into a particular polypeptide molecule. Messenger RNA goes from the nucleus to the cytoplasm of a cell. ↑ NUCLEOTIDE → CISTRON

TB009 transfer RNA (*n.*) A relatively short strand of RNA with an amino acid attached to one end of the molecule and the genetic code for the amino acid at the other end. Transfer RNA is found only in the cytoplasm of cells. ↑ NUCLEOTIDE

TB010 ribonucleic acid (*n.*) See RNA. ↓ RIBOSENUCLEIC ACID · DEOXYRIBONUCLEIC ACID ↑ NUCLEIC ACID · RNA

TB011 ribosenucleic acid (*n.*) Alternative term for RIBONUCLEIC ACID (↑).

TB012 deoxyribonucleic acid (*n.*) See DNA (↑).

TB013 transcription (*n.*) The process of producing a molecule of RNA from a length (or cistron) of DNA. The process is catalysed by the enzyme, transcriptase (also known as RNA polymerase). A cistron of DNA acts as a template for the production of molecules of messenger RNA. —***transcribe*** (*v.*) ↓ TRANSLATION · REPLICATION · GENETIC CODE · BIOPOIESIS · TEMPLATE · STRAND ↑ NUCLEIC ACID · DNA · RNA → CISTRON

TB014 translation (*n.*) The process performed by transfer RNA and carried out in a ribosome, which translates the genetic code on messenger RNA into a sequence of amino acids in a peptide chain to synthesize a protein. —***translate*** (*v.*) ↓ GENETIC CODE ↑ RNA · TRANSCRIPTION

TB015 replication (*n.*) The process whereby a molecule of deoxyribose nucleic acid (DNA) produces an exact copy of itself. The process is catalysed by the enzyme polymerase; each strand of a DNA molecule produces a complementary strand, *i.e.* a positive strand produces a negative strand, and vice-versa. In this way the original positive and negative strands of the original DNA each produce a complementary strand, and one molecule of DNA replicates to form two molecules. The original DNA molecule is called a primer. —***replicate*** (*v.*) ↑ TRANSCRIPTION → REPRODUCTION

TB016 genetic code The sequence of amino acids in a protein is determined by the sequence of the nucleotides in a molecule of messenger RNA. A triplet code of 3 consecutive bases (from the nucleotides) identifies a particular amino acid. This is the genetic code. There are 4 different bases in the nucleotides, so there are 64 combinations of bases for a triplet of nucleotides. Most amino acids have more than one identifying triplet code. There are also triplet codes for starting and stopping a peptide chain in a protein. The coded messenger RNA is obtained by transcription from strands of DNA in the chromosomes. The DNA thus stores the information to produce proteins which determine the characteristics and functions of the individual. The genetic code is of universal occurrence in living organisms. ↑ NUCLEOTIDE · DNA · RNA → GENE · CHROMOSOME

TB017 biopoiesis (*n.*) The generation of living organisms from replicating

molecules. ↑ TRANSCRIPTION

TB018 template 1 A thin board or metal plate cut to an exact size or shape, used as a guide to make objects exactly alike without the necessity of making measurements; these objects are replicas. **2** Any device, whether inanimate or animate, which enables a replica to be made.

TB019 strand (*n.*) **1** (G.S.) One of the threads, strings, or wires, twisted together to make a rope. **2** (Bio.) One of two or more separate long structures twisted or twined together to form a new stronger structure. A single-stranded structure can also be considered in relation to a similar structure with several strands. —***stranded*** (*adj.*) ↑ TRANSCRIPTION

Genes

TC001 gene (*n.*) A unit factor of heredity carried in a chromosome; the different traits and characteristics of individuals are passed on from generation to generation by sets of genes in the chromosomes of all cells. The genes are arranged in order along the length of a chromosome and in any one chromosome the genes, as a general rule, are all different. Each member of a pair of autosomes has a similar set of genes arranged in the same linear order (see **locus** TC005). Genes may be altered by mutation in several different ways. At the start of mitosis, the genes in each chromosome are replicated, and the chromosome becomes doubled, so that after cell division the two daughter cells have a full complement of chromosomes. Replication of the genes thus ensures inheritance of all the characteristics and traits. A gene is a length of DNA influencing a particular set of characters in a particular way, and also a short segment of a chromosome □ *a gene is responsible for a particular trait; genes are passed on or transmitted from one generation to the next; a gene determines a characteristic in an individual; in colour-blindness, a recessive gene is manifested; colour-blindness arises from a sex-linked gene; a gene is carried in a gamete and carried in a chromosome; an organism bears a defective gene; a gene performs a function; a gene is responsible for the synthesis of an enzyme; a parent replicates a gene in its offspring* —***genetic*** (*adj.*) ↓ ALLELE · GENOTYPE · DOMINANCE-RECESSIVENESS · STRUCTURAL GENE · GENETICS · DELETERIOUS · DOMINANT[1] · HOMOZYGOUS · MUTATION · LINKAGE[2] · SEGREGATION → HEREDITY

TC002 allele (*n.*) Two or more genes are said to be alleles if, ***a*** one can mutate to the form of the other; ***b*** they occupy the corresponding locus in each one of a pair of homologous chromosomes; ***c*** they give rise to different traits or characteristics during development of the individual. If there are more than two alleles, they form a set of alleles or an allelomorphic series; not more than two members of the set are simultaneously present in a normal diploid cell, one in each of a homologous pair of chromosomes, *e.g.* there are 3 alleles of the gene giving rise to the ABO blood group system; they are labelled G^A, G^B, G. The normal diploid cell has two of these alleles, one in each of a homologous pair of chromosomes; this leads to six possible combinations of genes, *i.e.* G^AG^A; G^AG; G^BG^B; G^BG; G^AG^B; GG □ *one gene is an allele of another; two alleles of the same gene associate in a diploid nucleus* —***allelic*** (*adj.*) ↓ ALLELOMORPH (Sn) · ALLELOMORPHISM · LOCUS · CISTRON · CHROMOSOME MAP · HOMOLOGUE[2] · PLASMAGENE ↑ GENE → CHROMOSOME

TC003 allelomorph (*n.*) One of a pair of alternative genes present in a homologous pair of chromosomes, *e.g.* two genes are responsible for the colour of the iris in the eye, one gene giving rise to blue eyes and one to brown eyes; the gene giving rise to blue eyes is an allelomorph of the gene giving rise to brown eyes, and vice versa. In a set of alleles, any two genes present in a homologous pair of chromosomes are allelomorphs of each other □ *of the two genes controlling the colour of eyes, the one for blue eyes is the recessive allelomorph* —ALLELOMORPHISM (*n.*) ALLELOMORPHIC, NON-ALLELOMORPHIC (*adj.*) ↑ ALLELE (Sn)

TC004 allelomorphism (*n.*) The condition exhibited by a gene which exists in alternative forms. ↑ ALLELE

TC005 locus (*n.,pl.* **loci**) The position occupied by a particular gene in a chromosome; in an homologous chromosome the corresponding position is occupied by an identical gene or by an allelomorph. During meiosis, corresponding loci on homologous chromosomes pair off. ↑ ALLELE

TC006 cistron (*n.*) A length of DNA within which a number of loci are integrated for the production of a specific polypeptide chain that performs one function in a cell or organism. Mutations within a cistron can occur (see **cis-trans effect** TC045), the smallest mutable unit being one to three nucleotide pairs. The cistron defines a unit of function in genetic terms only, *i.e.* solely from experimental evidence without knowing the polypeptide chains involved in the function. ↓ CIS-TRANS EFFECT ↑ ALLELE

TC007 chromosome map (*n.*) A linear diagram showing the position of genes in a chromosome; it is determined experimen-

tally by observations of the linkages of genes. ↑ ALLELE → LINKAGE[2]

TC008 homologue[2] (*n.*) Two genes in corresponding loci in homologous chromosomes are homologues of each other. —HOMOLOGOUS (*adj.*) ↑ ALLELE

TC009 plasmagene (*n.*) A heritable, protein particle in cytoplasm; it affects the characteristic of the cell bearing it. It is similar to a gene in that it is replicated in cell division, but it is dissimilar in that it is not inherited through the chromosomes of gametes and thus does not follow Mendelian patterns of inheritance. ↑ ALLELE

TC010 genotype (*n.*) The genetic composition of an organism; the total number and kinds of genes encoded into DNA of a nucleus in each cell of an organism. In general use, the genotype of an individual is considered in relation to one or two sets of alleles only; in the case of one set of alleles, the number of genotypes depends on the possible combinations of pairs of alleles. If there are 2 alleles, A and B, there will be three genotypes: AA, AB, BB. With 3 alleles there are six possible genotypes. —***genotypic*** (*adj.*) ↓ PHENOTYPE · PUNNETT SQUARE ↑ GENE · ALLELE

TC011 phenotype (*n.*) The observable traits and characteristics of an organism. Organisms of the same phenotype can be of different genotypes, *e.g.* homozygotes and heterozygotes with a dominant allelomorph. Organisms of the same genotype can have different phenotypes owing to variations produced by the environment. In general use, the phenotype of an individual is considered in relation to one, or possibly two, genetic factors, *e.g.* blue-eyed and brown-eyed phenotypes. Brown-eyed phenotypes can be either homozygous or heterozygous, because the gene giving rise to brown eyes is dominant. —***phenotypic*** (*adj.*) ↑ GENOTYPE

TC012 Punnett square (*n.*) A table in the form of a square used to represent, ***a*** the random combination of genes; ***b*** inherited Mendelian factors. It shows that all the possible combinations and the theoretical ratios of phenotypes and genotypes in a population can be determined, *e.g.* a Punnett Square to show sex-linked characteristics. ↑ GENOTYPE → MENDELIAN FACTORS · MENDEL'S LAWS

TC013 dominance-recessiveness (*n.*) A relation between two alleles which is common in genetic material, but does not exist in all cases. Some genes have a cumulative effect, some are co-dominant, some are incompletely dominant. —***dominant-recessive*** (*adj.*) ↓ HETEROZYGOTE · HOMOZYGOTE · HETEROZYGOSIS · HOMOZYGOSIS ↑ GENE → DOMINANT

TC014 heterozygote (*n.*) An individual which has two different forms of a gene, the normal gene for a characteristic and its mutant, at the corresponding points on a pair of homologous chromosomes. The individual produces two genetically different gametes for the gene under consideration. ↓ HOMOZYGOTE (Cn) ↑ DOMINANCE-RECESSIVENESS

TC015 homozygote (*n.*) An individual which has identical genes at corresponding points on a pair of homologous chromosomes; it will always replicate the same gene in its offspring. ↑ DOMINANCE-RECESSIVENESS · HETEROZYGOTE (Cn)

TC016 heterozygosis (*n.*) The state of a heterozygote, *i.e.* the condition of producing two genetically different gametes as regards the gene under consideration. ↓ HOMOZYGOSIS (Cn) ↑ DOMINANCE-RECESSIVENESS

TC017 homozygosis (*n.*) The state of a homozygote; *i.e.* the condition of always producing gametes of one type for the gene under consideration. ↑ DOMINANCE-RECESSIVENESS · HETEROZYGOSIS (Cn)

TC018 structural gene (*n.*) A gene responsible for the synthesis of an enzyme or other polypeptide chain. ↓ OPERATOR GENE · REGULATOR GENE · OPERON · EFFECTOR[2] · REPRESSOR ↑ GENE → ENZYME

TC019 operator gene (*n.*) A gene that is not itself responsible for the synthesis of any polypeptide chain, but instead controls the activity of a structural gene or genes. ↑ STRUCTURAL GENE

TC020 regulator gene (*n.*) A gene that controls the activity of an operator gene by the production of a repressor substance or of an inactive substance taking part in regulation. Regulation by the gene can take place in one of two ways. ***a*** The repressor substance inactivates an operator gene; a metabolite (an effector) can inactivate the repressor substance, and the operator gene again becomes active. (The effector can come from within the cell or from outside the cell.) The effector in this case switches on the gene system. ***b*** The inactive substance produced by the regulator gene combines with a metabolite (an effector) to form a repressor substance which inactivates the operator gene (The effector can come from within or from outside the cell.). The effector in this case switches off the gene system. ↑ STRUCTUPAL GENE

TC021 operon (*n.*) A group of gene systems containing operator and structural genes that are closely linked in the production of an enzyme system in bacteria, particularly adaptive enzyme systems, and probably act in a similar fashion in other organisms. The operon is controlled by a regulator gene which is not part of the operon, *e.g.* in *E. coli* one gene is responsible for the production of lactase and another gene for the production of thiogalactosidase (two structural genes) These two genes are controlled by an operator gene A regulator gene produces a repressor which inactivates the operator gene. In the presence of lactose (a metabolite) the repressor combines with lactose and no longer inactivates the operator gene, so the two enzymes are produced The lactose is an effector In the

absence of lactose the enzymes are not produced. ↑ STRUCTURAL GENE

TC022 effector[2] (*n.*) See REGULATOR GENE (↑).

TC023 repressor (*n.*) See REGULATOR GENE (↑).

TC024 genetics (*n.sing.*) The study of variation in heredity in respect to the function of genes. ↑ GENE

TC025 deleterious (*adj.*) Harmful; describes a gene which reduces the chances of an organism for survival or for reproduction, without being lethal, *e.g.* in many cases gene mutations are deleterious to the organism in which they occur and such mutants either do not survive for long or do not reproduce many offspring □ *certain traits are deleterious to an organism* ↓ GENETIC · DEFECTIVE · LETHAL ↑ GENE → ADVANTAGEOUS (An)

TC026 genetic (*adj.*) Of or to do with genes or genetics. ↑ GENE

TC027 defective (*adj.*) Describes a structural gene that has lost the ability to perform its function, *e.g.* a defective gene gives rise to albinism; the gene is recessive, as are most defective genes. ↓ RECESSIVE ↑ DELETERIOUS

TC028 lethal (*adj.*) Describes a gene which causes the death of an individual at any stage from the embryo to the adult. Any one dominant lethal gene will kill the individual bearing it. A recessive lethal gene, which is much commoner, only kills individuals homozygous for the gene. Lethal genes can be sex-linked. A lethal gene may cause spontaneous abortion. —***lethality*** (*n.*) ↑ DELETERIOUS

TC029 dominant[1] (*adj.*) **1** (Genetics) A gene which produces the same trait, characteristics, or qualities, whether present with an allelomorph (*i.e.* heterozygous) or present with an identical gene (*i.e.* homozygous), *e.g.* the gene for brown eyes is dominant to the gene for blue eyes; an individual with one gene for brown colour and one gene for blue colour will have brown eyes. **2** (Ecology) In a plant community the most abundant species is the dominant species. The dominant species to a large extent governs the type and the abundance of other plant species in the community. —***dominance*** (*n.*) ***dominate*** (*v.*) ↓ RECESSIVE (1) · CODOMINANT · ALLELOMORPHIC · NON-ALLELOMORPHIC ↑ GENE → ALLELOMORPH · CHARACTERISTIC[1] · COMMUNITY

TC030 recessive (*adj.*) **1** Used to describe a gene which only produces a trait, a quality, or a characteristic, when present with an identical gene (*i.e.* when homozygous for that gene). If an individual possesses a dominant gene and a recessive gene the characteristic is that of the dominant gene and the recessive gene is ineffective. **2** Used to describe the trait or characteristic produced by a recessive gene or recessive Mendelian factor —***recessiveness*** (*n.*) ↑ GENE · DOMINANT[1](1) → TRAIT CHARACTERISTIC[1]

TC031 codominant (*adj.*) Two alleles can be codominant, *i.e.* they both give rise to their own traits or characteristics in an individual, *e.g.* the alleles G^A and G^B are respectively responsible for blood groups A and B in the ABO system; an individual possessing both alleles has blood group AB, with the characteristics of both blood group A and blood group B. The two genes, G^A and G^B, are codominant, and either gene is dominant to the recessive gene, G, the gene in a homozygous individual with blood group O □ *two genes are codominant to each other* —***codominance*** (*n.*) ↑ DOMINANT[1]

TC032 allelomorphic (*adj.*) Possessing the characteristics of an allelomorph, *e.g.* ***a*** if two genes are present in corresponding loci in a homologous pair of chromosomes, one gene is allelomorphic to the other if it gives rise to a different trait or characteristic; ***b*** in a set of alleles, any one allele is allelomorphic to all the others, *i.e.* allelomorphic genes belong to the same set of alleles □ *one gene is allelomorphic to a corresponding gene* ↓ NON-ALLELOMORPHIC (Cn) ↑ DOMINANT[1]

TC033 non-allelomorphic (*adj.*) Describes two or more genes that do not belong to the same set of alleles. ↑ DOMINANT[1] ALLELOMORPHIC (Cn)

TC034 homozygous (*adj.*) **1** Having identical genes at a particular locus in a homologous pair of chromosomes; the individual is homozygous for the gene. **2** Having identical genes in a gene pair for a particular trait or characteristic □ *a blue-eyed man is homozygous for the gene responsible for eye colour* —HOMOZYGOTE, HOMOZYGOSIS (*n.*) ↓ HETEROZYGOUS (Cn) · HEMIZYGOUS ↑ GENE

TC035 heterozygous (*adj.*) **1** Possessing two allelomorphs at a particular locus in a homologous pair of chromosomes; the individual is heterozygous for the gene. **2** Possessing allelomorphs in a gene pair for a particular trait or characteristic □ *a brown-eyed man may be heterozygous for the gene responsible for eye colour* —HETEROZYGOTE, HETEROZYGOSIS (*n.*) ↑ HOMOZYGOUS (Cn)

TC036 hemizygous (*adj.*) **1** Describes a gene in a haploid organism, *i.e.* there is no homologue of the gene. **2** Describes an organism with one gene in a sex chromosome and no homologue in the other sex chromosome. A male organism is hemizygous for many genes in the X-chromosome if there is no corresponding locus on the Y-chromosome (where Y-chromosomes determine a male) □ *a male organism is hemizygous for the gene responsible for colour-blindness* ↑ HOMOZYGOUS

TC037 mutation (*n.*) A spontaneous, localized change in the DNA of a chromosome, normally an infrequent event. It occurs on average once in 10^6 cell divisions. The rate of mutation is made faster by irradiation from electro-magnetic waves of short wavelength, *e.g.* X-rays or γ-rays, by

bombardment with neutrons, and by a few specific chemicals. The occurrence of gene mutation is variable and depends upon the gene which is mutating when it arises as described above and causes a change in an individual gene. Mutation can also arise from structural changes in chromosomes, *e.g.* chromosomal aberrations, and also from changes in the number of chromosomes, such as polyploidy. Mutations occurring in gametes are more important than mutations in somatic cells, since changes in the gametes are passed on to the next generation. —MUTABLE, MUTATIVE, MUTATIONAL (*adj.*) ***mutate*** (*v.*) ↓ MUTANT[1] · CHROMOSOMAL ABERRATIONS · CIS-TRANS EFFECT · HETEROKARYON · MUTABLE ↑ GENE

TC038 mutant[1] (*n.*) **1** An organism, within a particular population under observation, which bears a gene having undergone mutation, *e.g.* a grey goose born in a flock of white geese is a mutant. **2** A gene which has undergone mutation. **3** A characteristic, or trait, which appears spontaneously in an organism or within a group of organisms, *e.g.* the grey colour of the goose in the example above is a mutant. ↑ MUTATION → WILD TYPE (An)

TC039 chromosomal aberrations (*n.pl.*) During meiosis, the chromosomes or chromatids may become broken and subsequently rejoined; the result is a mutation of the genes in the chromosomes. The various types of chromosomal aberrations are: deletion, duplication, translocation, inversion, and crossing-over. ↓ DELETION · DUPLICATION · TRANSLOCATION · INVERSION · CROSSING-OVER[2] ↑ MUTATION → CHROMOSOME

TC040 deletion (*n.*) The process in which a segment of the chromosome is deleted and lost to the chromosome, losing some of the genes. ↑ CHROMOSOMAL ABERRATIONS

TC041 duplication (*n.*) The process in which a segment of the chromosome is doubled and some genes consequently are present twice at different loci in the chromosome. ↑ CHROMOSOMAL ABERRATIONS

TC042 translocation (*n.*) The process in which a segment of one chromosome is transferred to another chromosome ↑ CHROMOSOMAL ABERRATIONS

TC043 inversion (*n.*) The process in which a segment of a chromosome is broken off and rejoined in a reversed position. ↑ CHROMOSOMAL ABERRATIONS

TC044 crossing-over[2] (*n.*) The process in which mutual exchange takes place between chromatids of homologous chromosomes during meiosis, so that segments are exchanged. This causes a failure in linkage, except in the case of closely linked genes. The points in the chromosome where crossing-over takes place are known as **chiasmata.** ↓ LINKAGE[2] ↑ CHROMOSOMAL ABERRATIONS → CHIASMATA · MEIOSIS

TC045 cis-trans effect (*n.*) If two defective mutations occur at two different loci in a pair of homologous chromosomes, two arrangements are possible ***a*** both mutations are carried in one chromosome, the other chromosome being normal (cis-arrangement); ***b*** one mutation is carried in each chromosome, neither chromosome being normal (trans-arrangement). If the genes undergoing mutation perform different functions, then there will be no difference in phenotypes between the two arrangements, since each arrangement will have a dominant-recessive pair of genes for each function. If the genes belong to the same functional unit, *i.e.* a cistron, then in the cis-arrangement one set of the two genes is normal (so the cistron is normal) and hence the phenotype is normal. In the trans-arrangement, both sets of genes are defective, so both cistrons are defective, and hence the phenotype is abnormal. A cistron can thus be defined from the cis-trans effect, *i.e.* a length of chromosome within which complementation does not occur, but a cis-trans effect does occur. ↓ CIS-ARRANGEMENT · TRANS-ARRANGEMENT · COMPLEMENTATION ↑ MUTATION

TC046 cis-arrangement (*n.*) See CIS-TRANS EFFECT (↑).

TC047 trans-arrangement (*n.*) See CIS-TRANS EFFECT (↑).

TC048 complementation (*n.*) **1** The effect observed when in two different cistrons in a pair of homologous chromosomes, the offspring show no difference in phenotype, as each pair of homologous chromosomes has one normal and one defective gene. In a trans-arrangement, each chromosome supplies the deficiency of the other; in a cis-arrangement, the mutations behave as normal recessive factors. Complementation takes place in the trans-arrangement, and this is **inter-cistron complementation. 2** If a trans-arrangement of corresponding cistrons is used to produce offspring, recombination of the original genes may take place and a normal phenotype reappears. This is **intra-ciston complementation.** ↑ CIS-TRANS EFFECT

TC049 heterokaryon (*n.*) (In fungi) an individual having genetically dissimilar haploid nuclei, either in a cell or in the cytoplasm of its hyphae. A variation in the proportion of the dissimilar nuclei gives rise to variation in the growth of the organism and allows for adaptation to take place. The cis-trans effect is also observed in a heterokaryon; in the cis-arrangement both mutations are carried in the same nucleus; in the trans-arrangement they are carried in dissimilar nuclei. Complementation can also take place in a heterokaryon and the mechanism is the same as in diploid nuclei —***heterokaryosis*** (*n.*) ***heterokaryotic*** (*adj.*) ↓ HOMOKARYON (Cn) · HETEROCARYON · HOMOCARYON ↑ MUTATION

TC050 homokaryon (*n.*) (In fungi) an individual having genetically identical haploid nuclei —***homokaryosis*** (*n.*) ***homokaryotic*** (*adj.*) ↑ HETEROKARYON (Cn)

TC051 heterocaryon (*n.*) Alternative term for HETEROKARYON (↑).

TC052 homocaryon (*n.*) Alternative term for HOMOKARYON (↑).

TC053 mutable (*adj.*) Describes a gene or trait which can undergo mutation. ↓ MUTANT[2] · MUTATIVE · MUTATIONAL ↑ MUTATION

TC054 mutant[2] (*adj.*) Describes a gene which has undergone mutation. ↑ MUTABLE

TC055 mutative (*adj.*) Describes an agent of mutation, *e.g.* X-rays have mutative properties. ↑ MUTABLE

TC056 mutational (*adj.*) Describes a process connected with mutations, *e.g.* the mutational effect of radiation from electromagnetic waves. ↑ MUTABLE

TC057 linkage[2] (*n.*) The tendency of two or more non-allelomorphic genes, *i.e.* genes in the same chromosome, to remain associated through several generations. The genes are passed on from generation to generation as an inseparable combination; they do not exhibit independent assortment. Such genes may be separated as a result of the crossing-over of chromosomes, but the nearer the genes are to each other in the chromosome, the more likely they are to remain linked. Genes with a high tendency to remain linked are said to be closely linked. —***linked*** (*adj.*) ↓ LINKAGE GROUP · CROSS-OVER VALUE · F+ · TRANSFORMATION · HOLANDRIC ↑ GENE

TC058 linkage group (*n.*) The set of genes in one chromosome. ↓ GENOME · GENOM · SEX-LINKAGE · SEX-LIMITED GENE ↑ LINKAGE[2]

TC059 genome (*n.*) The minimum, complete set of all different chromosomes found in each nucleus of a given species of organism. A haploid individual has one genome, a diploid individual has two genomes; a bacterium has only one genome.

TC060 genom (*n.*) Alternative term for GENOME (↑).

TC061 sex-linkage (*n.*) The manner of distribution to gametes of alleles in sex chromosomes. Sex-linked genes in the gametes determine sex-linked characteristics in the individual. In mammals there are three distinct areas of the sex chromosomes: ***a*** the part of the X-chromosome and the part of the Y-chromosome which are homologous, ***b*** the part of the X-chromosome which is not homologous with any part of the Y-chromosome; ***c*** the part of the Y-chromosome which is not homologous with any part of the X-chromosome. In male humans, a large number of recessive genes are manifested as these genes are on X-chromosomes non-homologous with Y-chromosomes, *e.g.* haemophilia and colour-blindness arise from such sex-linked genes. A female human only manifests these recessive genes if she is homozygous for the gene, which happens rarely □ *sex-linkage of genes occurs in haemophilia* ↑ LINKAGE GROUP

TC062 sex-limited gene (*n.*) A gene manifested in only one sex, *e.g.* the genes for secondary sexual characteristics. In males it is an holandric gene. ↓ HOLANDRIC ↑ LINKAGE GROUP

TC063 cross-over value (*n.*) A measurement of the tendency of two genes in different segments of the same chromosome to be separated during crossing-over. It is the frequency with which one of the two genes is exchanged for an allelomorph from a homologous chromosome and it is measured from the percentage of genes containing the allelomorph. Closely linked genes have a very low cross-over value, and conversely, genes not closely linked have a higher cross-over value. ↑ LINKAGE[2]

TC064 F⁺ (*abbr.*) (In bacteria) a genetic donor, which transfers genetic material, as part of the chromatin thread, to a genetic receptor (F^-) which receives the material. ↓ F^- · EPISOME · MEROZYGOTE ↑ LINKAGE[2]

TC065 F⁻ (*abbr.*) (In bacteria) a genetic receptor, F stands for ***fertility.*** ↑ F^+

TC066 episome (*n.*) A discrete genetic particle in a bacterial cell; it lies in the chromatin thread or near to it. Possession of an episome makes a bacterial cell, F', a genetic donor. During the transfer of chromatin thread between two conjugating bacterial cells the episome leads the genetic material into the genetic receptor. ↑ F^+

TC067 merozygote (*n.*) (In some bacteria) a zygote containing only part of a complete set of genes (a genome) from a donor bacterium, together with its own complete set of genes. A merozygote results from two conjugating bacteria separating before the transfer of all genetic material has been completed. A merozygote can also result from transduction and transformation. ↓ TRANSFORMATION · TRANSDUCTION ↑ F^+

TC068 transformation (*n.*) A phenomenon observed in the behaviour of the genetic material of bacteria. If certain bacteria are cultured in the presence of dead bacterial cells, or a culture of related strains of bacteria, the cultured bacteria acquire some of the genetic characteristics of the related strains. ↓ TRANSDUCTION ↑ LINKAGE[2]

TC069 transduction (*n.*) The transfer of genetic material from a donor bacterium to a recipient bacterium by means of a bacteriophage. The DNA (or genes) become incorporated in the bacteriophage; on the death of the bacterium, the bacteriophage acts as a vector in the transport of the genetic material to other bacteria. ↑ TRANSFORMATION

TC070 holandric (*adj.*) Describes a gene on the non-homologous part of the Y-chromosome, *i.e.* a sex-linked gene giving rise to characteristics only transmitted from male to male. ↓ HOLOGYNIC (Cn) ↑ LINKAGE[2]

TC071 hologynic (*adj.*) Describes a sex-linked gene giving rise to characteristics only transmitted from female to female. ↑ HOLANDRIC (Cn)

TC072 segregation (*n.*) The separation of two alleles from a pair of homologous chromosomes during meiosis so that each allele is carried in a different gamete; the alleles persist unchanged during meiosis and during their association in a diploid

nucleus; no alteration or blending of the alleles takes place. Segregation is both the separation of a pair of alleles during meiosis, and the formation of a pair of alleles during fertilization, and depends upon the unchanging nature of the genes and their carriage in a pair of homologous chromosomes. Mendel's first law states that allelomorphic genes segregate and the inheritance of traits and characteristics depends on segregation. —***segregate*** (*v.*) ↓ INDEPENDENT ASSORTMENT · GENE FREQUENCY · SELECTION ↑ GENE → MEIOSIS · MENDEL'S LAWS

TC073 independent assortment (*n.*) The manner of distribution of alleles to gametes; the distribution of any one pair of alleles has no influence on the distribution of any other pair of alleles; distribution is purely by chance. If an individual has one pair of alleles, Aa, and another pair, Bb, on different pairs of chromosomes, then equal numbers of gametes will be formed from the four possible chance combinations, *i.e.* (A and B); (a and B); (A and b); (a and b). This distribution does not apply to linked genes because they are in the same chromosome. The independent assortment of alleles arises from the independent behaviour of chromosomes during meiosis. ↑ SEGREGATION

TC074 gene frequency (*n.*) The frequency of occurrence, expressed as a percentage, of one allele compared with all the other allelomorphs of a set of alleles in a stated population. The frequency of an allele in a population can vary between 1% and 99%. An equilibrium, arising from random mating, is usually reached, in which the gene frequencies remain constant from generation to generation, resulting in the distribution of phenotypes also remaining constant. ↓ GENETIC DRIFT · GENE EXCHANGE · GENE FLOW · GENE POOL ↑ SEGREGATION

TC075 genetic drift (*n.*) The gradual shift in the equilibrium of gene frequency arising from the introduction of successful mutations or the deletion of mutations that have become disadvantageous, *e.g.* in Africa 40% of the population exhibited the sickle-cell trait, an abnormal condition of haemoglobin of genetic origin. The responsible allele is deleterious and recessive, a person homozygous for the allele rarely reaches maturity. A heterozygous person survives and has a greater resistance to infection from malaria than a person with normal haemoglobin (an advantage). In the West Indies, the descendants of populations suffering from sickle-cell trait now experience conditions free from malaria. The result has been a reduction in the percentage of individuals exhibiting sickle-cell trait, showing a shift in the equilibrium of the alleles, caused by a change in the environment. This is an example of genetic drift. ↑ GENE FREQUENCY

TC076 gene exchange (*n.*) The exchange of genes that takes place in a breeding population. Chromosomal aberration in the gametic tissues also contributes to gene exchange, as these mutations are inheritable. The term is used in defining population units. ↑ GENE FREQUENCY → SPECIES[1] · ECOTYPE

TC077 gene flow (*n.*) (In a breeding population) the movement of genes resulting from gene exchange. ↑ GENE FREQUENCY

TC078 gene pool (*n.*) All the genes represented in a population under discussion; the term usually refers to the gene pool of a species. ↑ GENE FREQUENCY

TC079 selection (*n.*) Under natural conditions there is an enormous mortality in all species of animals and plants at all stages of life, otherwise a species would overpopulate the earth, *e.g.* the progeny of a rabbit could number 14 million in three years. Survival depends on the possession by an organism of variations in characteristics which are advantageous to it in its environment. The useful variations will be perpetuated and the less advantageous and the deleterious characteristics will gradually disappear. Selection is the process whereby successful variants reproduce progeny; it is the chief factor controlling the gene composition of a species during the course of time. ↓ PENETRANCE · EXPRESSIVITY · SELECTION PRESSURE ↑ SEGREGATION → EVOLUTION[2]

TC080 penetrance (*n.*) The frequency, as a percentage, of the manifestation of a gene in a population; the organisms manifesting the gene include all individuals bearing a dominant allelomorph and homozygous individuals bearing recessive allelomorphs. The penetration of many genes is 100%, but there are genes with a much lower penetrance. ↑ SELECTION

TC081 expressivity (*n.*) The intensity with which a gene produces a phenotypic effect in any one individual. A constant expressivity produces the same phenotypic effect in all individuals; a varying expressivity produces differing degrees of the phenotypic effect in different individuals. ↑ SELECTION

TC082 selection pressure (*n.*) The effectiveness of selection in causing genetic drift. ↑ GENETIC DRIFT · SELECTION

Chemical Potential

UA001 chemical potential The chemical potential of a pure substance is equal to the free energy per mole. ↓ CATALYST → FREE ENERGY

UA002 catalyst (*n.*) A catalyst is a substance which can increase the rate of a chemical reaction without itself undergoing permanent chemical change, *e.g.* vanadium pentoxide is used as a catalyst in the contact process for making sulphuric acid. —***catalysis*** (*n.*) ***catalyse*** (*v.*) ↓ RETARDER · PROMOTER · NEGATIVE CATALYST → ENZYME INHIBITOR · ACTIVATION ENERGY

UA003 retarder (*n.*) A substance used to slow down a chemical action. ↑ CATALYST → INHIBITOR

UA004 promoter (*n.*) Substances added in small quantities to a catalyst to increase the activity of the catalyst, *e.g.* in the Haber process, aluminium acts as a promoter of the iron catalyst. ↑ CATALYST

UA005 negative catalyst (*n.*) A substance which slows down a reaction. They operate in two ways: in one of these the negative catalyst disrupts the reaction mechanism, in the second the negative catalyst destroys the activity by direct reaction with the catalyst. ↑ CATALYST

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antisepsis *(n.)* JC096
antiseptic *(n.)* JC093
antiserum *(n.)* JB050
antithetic *(adj.)* SD031
antitioxin *(n.)* JB013
antler *(n.)* CF004
Anura *(n.pl.)* CC155
anus *(n.)* MF044
anvil *(n.)* HD038
aorta *(n.)* PA016
aortic arches *(n. pl.)* PA019
ape *(n.)* CC215
aperiodic *(adj.)* NB123
aperiodic circuit *(n.)* NL055
aperture[1] *(n.)* (Ph) ND054
aperture[2] *(n.)* (Bio) CG293
Apetalae *(n.pl.)* CB114
apetalous *(adj.)* SF060
apex *(n.)* CG073
aphyllous *(adj.)* CE063
apical *(adj.)* CG081
apical bud *(n.)* CE017
apical dominance *(n.)* CE029
apical meristem *(n.)* CS038
aplanospore *(n.)* SC024
apo- *(pre.)* AL024
apocarpous *(adj.)* SF140
apocrine *(adj.)* CM048
Apoda *(n.pl.)* CC157
apogamy *(n.)* SA039
apomixis *(n.)* SA050
aponeurosis *(n.)* FB040
apoplexy *(n.)* CR083
aposematic *(adj.)* GA099
apospory *(n.)* SA040
apothecium *(n.)* SF186
apparatus *(n.)* AQ008
apparent *(adj.)* AM040
apparent depth *(n.)* ND047
appendage *(n.)* CJ066
appendicular *(adj.)* CJ084
appendicular skeleton *(n.)* CK072
appendix *(n.)* MF050
appetite *(n.)* MH013
Appleton layer *(n.)* NC053
application *(n.)* AJ046
apply *(v.t.)* AJ061
apposition *(n.)* CT037
apposition image *(n.)* HC035
appreciable[1] *(adj.)* (Bio, Ch, Ph) AN059
appreciable[2] *(adj.)* (Ch) BB057
appropriate *(adj.)* AP036
approximate *(adj.)* AN024
approximation *(n.)* AN006
aprotic solvent *(n.)* DD005
apterous *(adj.)* CF078
apterygial *(adj.)* CF076

Apterygota *(n.pl.)* CC070
aqua- *(pre.)* AL102
aqua-ion *(n.)* EG039
aquatic *(adj.)* GA058
aqueous *(adj.)* DD034
aqueous humour *(n.)* HC048
arable *(adj.)* GB018
arachnid *(n.)* CC065
Arachnida *(n.pl.)* CC092
arachnoid *(n.)* HB088
Araneae *(n.pl.)* CC098
Araneida *(n.pl.)* CC097
arbitrary *(adj.)* AN093
arboreal *(adj.)* GA056
arborise *(v.i.)* CG213
arc lamp *(n.)* NE024
arche- *(pre.)* AL077
Archegoniatae *(n.pl.)* CB003
archegonium *(n.)* SB133
archenteron *(n.)* SH050
archesporium *(n.)* SC013
archicarp *(n.)* SF201
Archichlamydeae *(n.pl.)* CB108
Archimedes' principle *(n.)* KF015
arcing *(n.)* NE006
area[1] *(n.)* (Bio, Ch, Ph) AA021
area[2] *(n.)* (Bio) CG239
area opaca *(n.)* SH035
area pellucida *(n.)* SH034
area vasculosa *(n.)* SH036
areolar tissue *(n.)* CN005
arid *(adj.)* GA167
aridity index *(n.)* GA146
aril *(n.)* SD103
arillode *(n.)* SD104
arise *(v.i.)* AD045
arista *(n.)* SF082
aristate *(adj.)* SF088
aristulate *(adj.)* SF089
armature *(n.)* NK090
aromatic compound *(n.)* BD053
aromaticity *(n.)* BC068
arrangement *(n.)* AC009
arrest *(v.t.)* FG028
arterial *(adj.)* PA032
arterial system *(n.)* PA038
arteriole *(n.)* PA012
artery *(n.)* PA011
arthritic *(adj.)* CK140
arthritis *(n.)* CK134
arthrodia *(n.)* CK208
arthropod *(n.)* CC062
Arthropoda *(n.pl.)* CC053
articular *(adj.)* CK137
articular surface *(n.)* CG319
articulate[1] *(v.i.)* (Bio) CK136
articulate[2] *(adj.)* (Bio) CK138
articulated *(adj.)* CK139
articulation *(n.)* CK125
artificial *(adj.)* AB026
artificial immunity *(n.)* JB038
artificial manure *(n.)* GB043
artificial parthenogenesis *(n.)* SB054
artificial radioactivity *(n.)* NF003
Artiodactyla *(n.pl.)* CC202
aryl *(adj.)* BD095
Ascaroidea *(n.pl.)* CC036
Aschelminthes *(n.pl.)* CC040
ascocarp *(n.)* SB137
ascogonium *(n.)* SB136
Ascomycetes *(n.pl.)* CB052
ascorbic acid *(n.)* MH056
ascospore *(n.)* SB139
ascus *(n.)* SB138
asepsis *(n.)* JC095
aseptate *(adj.)* CG233
aseptic *(adj.)* JC106
asexual reproduction *(n.)* SC001
-asis *(suff.)* AL094
asleep *(adj.)* HB195
assert *(v.t.)* AM023
assertion *(n.)* AM011
assimilation *(n.)* MG007
assist *(v.t.)* AG140
Assman psychrometer *(n.)* EE079
associate *(v.i.)* AJ062
associate with *(v.i.)* AJ063
association[1] *(n.)* (Bio) GA129
association[2] *(n.)* (Bio) HB158
association[3] *(n.)* (Bio, Ch, Ph) AJ047
association[4] *(n.)* (Ch) KA032
association colloid *(n.)* DE019
association neuron *(n.)* HB014
association tracts *(n.pl.)* HB147
assume *(v.t.)* AM017
assumption *(n.)* AM003
astatic *(adj.)* NB113
aster *(n.)* CU044
astigmatism *(n.)* HC083
astragalus *(n.)* CK115
astronaut *(n.)* EC010
astronomical telescope *(n.)* ND076
asymmetrical *(adj.)* CG055
asymmetry *(n.)* CG035
atavism *(n.)* TA033
-ate *(suff.)* AL116
atlas *(n.)* CK020
atmospheric pressure *(n.)* KF010
atmospherics *(n.pl.)* NM022
atom *(n.)* BC049
atomic clock *(n.)* KG003
atomicity *(n.)* DC002
atomic mass unit *(n.)* DB022
atomic number *(n.)* DB016
atomic structure *(n.)* DB001
atomic weight *(n.)* DB021
atomize *(v.t.)* DE014
ATP *(abbr.)* MA046
atrichous *(adj.)* CA079
atrium *(n.)* PA045
atrophy *(n.)* FA023
attachment[1] *(n.)* (Bio) CG186
attachment[2] *(n.)* (Bio) FB031
attenuated *(adj.)* JB057
attract *(v.t.)* AJ067
attraction *(n.)* AJ055
attribute *(n.)* AB061
audibility[1] *(n.)* (Ph) NH058
audibility[2] *(n.)* (Bio) HD002
audible[1] *(adj.)* (Ph) NH035
audible[2] *(adj.)* (Bio, Ph) HD013
audience *(n.)* AK021
audiofrequency *(n.)* NM009
auditory *(adj.)* HD014
auditory capsule *(n.)* HD043
auditory nerve *(n.)* HB047
augment *(v.t.)* AG015
aural harmonics *(n.pl.)* NH062

auricle[1] *(n.)* (Bio) PA046
auricle[2] *(n.)* (Bio) HD021
autecology *(n.)* GA005
authentic *(adj.)* AM084
auto- *(pre.)* AL084
autoecious *(adj.)* SG009
autogamous *(adj.)* SA047
autogamy *(n.)* SA038
autogenesis *(n.)* CU016
autogenetic *(adj.)* SG012
autogenic *(adj.)* FD072
autogenous *(adj.)* FD073
autogeny *(n.)* CU015
autografting *(n.)* GB066
autolysis *(n.)* CT099
automatic gain control *(n.)* NM033
autonomic *(adj.)* FD074
autonomic ganglion *(n.)* HB051
autonomic nervous system *(n.)* HB009
auto-oxidation *(n.)* KA069
autophyte *(n.)* MB012
autophytic *(adj.)* MB024
autoplastic *(adj.)* GB078
autopolyploid *(n.)* CU029
autosome *(n.)* CU024
autotomy *(n.)* CJ055
autotrophic *(adj.)* MB019
aux AL147
auxanometer *(n.)* FA061
auxin *(n.)* JA072
auxotroph *(n.)* CA073
available[1] *(adj.)* (Bio, Ch, Ph) AJ094
available[2] *(adj.)* (Bio, Ch, Ph) AB030
avalanche diode *(n.)* NM087
avalanche effect *(n.)* NM078
average *(adj.)* AN092
average velocity *(n.)* EA023
Aves *(n.pl.)* CC175
avirulent *(adj.)* JC043
avitaminosis *(n.)* MH018
Avogadro number (constant) *(n.)* ED022
Avogadro's principle *(n.)* ED002
aware *(adj.)* HB196
awareness *(n.)* HB178
awn *(n.)* SF081
awned *(adj.)* SF087
axial *(adj.)* CG053
axial skeleton *(n.)* CK010
axil *(n.)* CE015
axile *(adj.)* CG052
axile placentation *(n.)* SF151
axillary *(adj.)* CE038
axis[1] *(n.)* (Bio) CK021
axis[2] *(n.)* (Bio) CG034
axis[3] *(n.)* (Bio) CH081
axle[1] *(n.)* (Ph) NA014
axle[2] *(n.)* (Ph) NA032
axon *(n.)* CQ011
axon terminal *(n.)* CQ018
azeotropic mixture *(n.)* DD041
azimuthal quantum number *(n.)* NC075

Bacillariophyceae *(n.pl.)* CB032
bacilliform *(adj.)* JC081
bacillus *(n.)* JC063
back e.m.f. *(n.)* NK061
backbone *(n.)* CK012
bacteria *(n.pl.)* JC058
bacterial oxidation *(n.)* KA068
bactericidal *(adj.)* JC077
bacteriochlorophyll *(n.)* MC003
bacteriology *(n.)* CA074
bacteriophage *(n.)* JC069
bacteriostatic *(adj.)* JC078
bacterium *(n.)* CA070
balance[1] *(n.)* (Bio, Ch, Ph) EB060
balance[2] *(v.)* (Bio, Ch, Ph) EB069
balanced diet *(n.)* MH017
balancer *(n.)* CF072
balancing liquid columns *(n.pl.)* KF022
ball and socket joint *(n.)* CK126
ballistic *(adj.)* EC033
ballistic galvanometer *(n.)* NJ094
ballistic missile *(n.)* EC003
ballistic pendulum *(n.)* EC023
ballistics *(n.sing.)* EC024
band spectrum *(n.)* ND101
barb[1] *(n.)* (Bio) CF046
barb[2] *(n.)* (Bio) CF083
barbicel *(n.)* CF086
barbule *(n.)* CF084
bark *(n.)* CS082
barometer *(n.)* KF028
barren[1] *(adj.)* (Bio) SB074
barren[2] *(adj.)* (Bio) FH046
barrier *(n.)* AJ013
barrier layer *(n.)* NM073
barrier layer cell *(n.)* NL072
barrier layer rectifier *(n.)* NM069
basal *(adj.)* CG082
basal ganglia *(n.pl.)* HB142
basal metabolic rate *(n.)* MA006
basal metabolism *(n.)* MA005
basal nuclei *(n.pl.)* HB143
basal placentation *(n.)* SF149
base[1] *(n.)* (Bio) CG074
base[2] *(n.)* (Ph) NM097
base[3] *(n.)* (Ch) BD003
basement membrane *(n.)* CM005
basic[1] *(adj.)* (Bio, Ch, Ph) AM031
basic[2] *(adj.)* (Ch) BC053
basicity *(n.)* BD013
basic oxide *(n.)* BD006
basic quantities *(n.pl.)* AN033
basic salt *(n.)* BD017
Basidiomycetes *(n.pl.)* CB054
basidiophore *(n.)* SC045
basidiospore *(n.)* SC019
basidium *(n.)* SC030
basilar membrane *(n.)* HD068
basipetal *(adj.)* FA037
bast *(n.)* PB018
bastard wing *(n.)* CF073
bast cell *(n.)* PB019
Batesian mimicry *(n.)* GA091
battery[1] *(n.)* (Bio) CG185
battery[2] *(n.)* (Ch, Ph) EG048
be *(v.i.)* AD004
beak *(n.)* ME039
beam[1] *(n.)* (Ph) KD027
beam[2] *(n.)* (Ch, Ph) NB011
beam balance *(n.)* EB061
bear *(v.t.)* SJ025
bearing[1] *(n.)* (Ph) NA033
bearing[2] *(n.)* (Ph) NA015
beat *(n.)* NH033

Beckmann thermometer *(n.)* LA025
become *(v.i.)* AD035
begin *(v.)* AD023
behaviour[1] *(n.)* (Bio) AJ009
behaviour[2] *(n.)* (Ch, Ph) AB062
behaviour[3] *(n.)* (Bio) HB173
bell *(n.)* NH092
belly *(n.)* FB039
beneficial *(adj.)* FG039
benign *(adj.)* JC042
benth- *(pre.)* AL105
benthic *(adj.)* GA202
benthon *(n.)* GA187
benthos *(n.)* GA191
benzene ring *(n.)* BD059
beri-beri *(n.)* JC186
Berkeley-Hartley osmometer *(n.)* ED017
Bernouilli effect *(n.)* KF011
Bernouilli's principle *(n.)* EC082
Bernouilli's theorem *(n.)* EC089
berry *(n.)* CE166
Berthollide compound *(n.)* NN005
β-emission *(n.)* NF010
β-particle *(n.)* NF006
betatron *(n.)* NE048
beverage *(n.)* MH010
bi- *(pre.)* AL052
biannual *(adj.)* CH027
bias[1] *(v.t.)* (Bio, Ch, Ph) AF064
bias[2] *(n.)* (Ph) NM101
bicarpellary *(adj.)* SF138
bicarpellate *(adj.)* SF133
biceps *(n.)* FB068
biceps brachii *(n.)* FB069
biceps femoris *(n.)* FB070
bicipital groove *(n.)* CK105
bicollateral bundle *(n.)* PB004
biconcave *(adj.)* CG248
biconvex *(adj.)* CG247
bicuspid *(adj.)* ME087
bicuspid valve *(n.)* PA053
biennial[1] *(adj.)* (Bio) CH028
biennial[2] *(n.)* (Bio) SD011
bifid *(adj.)* CG131
bifurcate *(v.i.)* CG211
bilateral *(adj.)* CG046
bilateral cleavage *(n.)* SH008
bilateral symmetry *(n.)* CG032
bile *(n.)* MA105
bile canaliculus *(n.)* MA110
bile channel *(n.)* MA111
bile duct *(n.)* MA115
bile pigments *(n.pl.)* MA108
bile salts *(n.pl.)* MA107
biliary *(adj.)* MA119
bilious *(adj.)* MA120
biliproteins *(n.pl.)* MC108
bilirubin *(n.)* MA109
bimetallic thermometer *(n.)* LA027
binary fission *(n.)* CU014
binding energy *(n.)* NF037
binocular vision *(n.)* HC008
binomial nomenclature *(n.)* CA016
binucleate *(adj.)* CT053
bio AL149
biochemical *(adj.)* AB074
biological *(adj.)* AB073
biological control *(n.)* GA072
bioluminescence *(n.)* FG023
biomass *(n.)* GA073
biome *(n.)* GA024
biometry *(n.)* GA003
bion *(n.)* GA031
bionomics *(n.)* GA004
biophyte *(n.)* GA108
biopoiesis *(n.)* TB017
biosphere *(n.)* GA002
biosynthesis *(n.)* FG020
biosystematics *(n.sing.)* CA020
biotic *(adj.)* GA048
biotic community *(n.)* GA029
biotic factors *(n.pl.)* GA144
biotic succession *(n.)* GA030
biotin *(n.)* MH068
biped *(n.)* FC013
bipinnate *(adj.)* CE126
bipolar *(adj.)* CQ021
biprism *(n.)* NB039
biramous *(adj.)* CG179
birefringence *(n.)* NB068
birefringent *(adj.)* NB084
birth *(n.)* SJ022
bisexual *(adj.)* SB037
bite *(v.)* ME094
bivalent *(n.)* CU056
bivalve *(n.)* CF063
Bivalvia *(n.pl.)* CC113
biventral *(adj.)* FB063
black-body radiation *(n.)* NC067
bladder *(n.)* CG273
bladderworm *(n.)* SD058
bland *(adj.)* BC028
blast AL160
blast furnace *(n.)* BB095
blastocoel *(n.)* SH029
blastocoele *(n.)* SH028
blastocyst *(n.)* SH041
blastoderm *(n.)* SH030
blastodisc *(n.)* SH031
blastomere *(n.)* SH014
blastopore *(n.)* SH051
blastula *(n.)* SH027
bleach[1] *(v.t.)* (Ch.) BB052
bleach[2] *(v.t.)* (Bio, Ch, Ph) BA012
blend *(v.t.)* AA074
blight *(n.)* JC074
blind spot *(n.)* HC087
block *(v.t.)* AJ029
block and tackle *(n.)* NA019
blocking capacitor *(n.)* NL061
blood *(n.)* CR001
blood corpuscle *(n.)* CR002
blood pressure *(n.)* PA061
blood sinus *(n.)* PA004
blood-sugar[1] *(n.)* (Bio) MA125
blood-sugar[2] *(n.)* (Bio, Ch) MD033
blood vessel *(n.)* PA010
bloom *(v.i.)* SF018
blossom *(n.)* SF008
blue-green algae *(n.pl.)* CB021
blurred *(adj.)* ND072
BMR *(abbr.)* MA007
board *(n.)* KD026
bob *(n.)* NB116
body[1] *(n.)* (Ph) AB010
body[2] *(n.)* (Bio) AB013
body-centered cube *(n.)* DA027
body regeneration *(n.)* FA008

bog *(n.)* GA150
Bohr's theory *(n.)* NC072
boil[1] *(v.)* (Ch) AD063
boil[2] *(n.)* (Ch) BB004
boil[3] *(v.)* (Ch) BB042
boiled *(adj.)* BB054
boiler *(n.)* NA039
boiling[1] *(adj.)* (Ch) BC026
boiling[2] *(n.)* (Ch) EE035
boiling point *(n.)* EE036
bolometer[1] *(n.)* (Ph) LB020
bolometer[2] *(n.)* (Ph) NJ079
bolus *(n.)* ME140
bomb calorimeter *(n.)* LB042
bond *(n.)* AA063
bond energy *(n.)* DA018
bone *(n.)* CN045
bone cell *(n.)* CN070
bony labyrinth *(n.)* HD046
bore[1] *(n.)* (Bio) CG281
bore[2] *(v.t.)* (Bio) CG298
borer *(n.)* MB007
Bosch process *(n.)* BB106
bottomed *(adj.)* NM124
bound[1] *(adj.)* (Bio, Ch, Ph) AA082
bound[2] *(v.i.)* (Bio) FC041
boundary *(n.)* AA010
Bourdon gauge *(n.)* KF025
bowed *(adj.)* NH113
Bowman's capsule *(n.)* FF040
Boyle's law *(n.)* EE007
Boyle temperature *(n.)* EE018
Brachiopoda *(n.pl.)* CC115
bract *(n.)* SF072
bracteal *(adj.)* SF083
bracteate *(adj.)* SF084
bracteoloate *(adj.)* SF086
bracteole *(n.)* SF073
bracteose *(adj.)* SF085
Bragg's law *(n.)* NB049
brain *(n.)* HB061
brain stem *(n.)* HB074
brake[1] *(n.)* (Ph) EC060
brake[2] *(v.t.)* (Ph) EC065
branch[1] *(v.i.)* (Bio) CG212
branch[2] *(n.)* (Bio.) CH011
branched chain *(n.)* BD066
branchial *(adj.)* MJ054
branchial arch *(n.)* MJ049
branchiate *(adj.)* MJ055
branching *(adj.)* CG217
Branchiopoda *(n.pl.)* CC058
break *(v.)* AG094
break down *(v.)* AF069
breaking stress *(n.)* KE011
breath *(n.)* MJ095
breathing *(n.)* MJ005
breathing roots *(n.pl.)* CH103
breed *(v.t.)* SA018
breeding *(n.)* SA016
Brewster's law *(n.)* NB058
bridge *(n.)* NH067
brief *(adj.)* AH028
bring about *(v.t.)* AD015
bristle *(n.)* CF043
brittle *(adj.)* BA023
broadcast *(v.)* NM035
bromide *(n.)* BD023
bromination *(n.)* KA016
bronchia *(n.pl.)* MJ071
bronchial *(adj.)* MJ088
bronchiole *(n.)* MJ072
bronchitis *(n.)* MJ085
bronchus *(n.)* MJ070
broody *(adj.)* SB102
broth *(n.)* MH011
brown algae *(n.pl.)* CB029
Brownian movement *(n.)* ED006
bruise *(n.)* JC088
brush discharge *(n.)* NE008
brushes *(n.pl.)* NK094
Bryophyta *(n.pl.)* CB078
Bryozoa *(n.pl.)* CC049
bubble[1] *(n.)* (Ch) BC034
bubble[2] *(n.)* (Ph) ED045
bubble[3] *(v.i.)* (Ch) AD064
bubble[4] *(v.t.)* (Ch) BB041
bubble chamber *(n.)* DF010
bubo *(n.)* JC132
buccal *(adj.)* ME016
buccal cavity *(n.)* ME020
bud[1] *(n.)* (Bio) SC057
bud[2] *(n.)* (Bio) CE016
budding[1] *(n.)* (Bio) SC007
budding[2] *(n.)* (Bio) SC008
budding[3] *(n.)* (Bio) GB063
bulb *(n.)* SC068
bulbil *(n.)* SC072
bulbous *(adj.)* CG134
bulk modulus *(n.)* KE015
bulla *(n.)* HD030
bumping *(n.)* BB009
bunch[1] *(n.)* (Bio, Ch, Ph) AA070
bunch[2] *(v.)* (Bio, Ch, Ph) AA078
buncher *(n.)* NC040
bundle of His *(n.)* PA064
buoyancy *(n.)* KF018
buoyant *(adj.)* KF034
burn *(v.i.)* AD057
burr *(n.)* CE145
burrow *(n.)* GA094
bush-fallow *(n.)* GB005
buttock *(n.)* CJ074
buttress roots *(n.pl.)* CH100
buzzer *(n.)* NK031
by-pass capacitor *(n.)* NL052
by-product *(n.)* BB086

cable[1] *(n.)* (Ph) KD033
cable[2] *(n.)* (Ph) NK100
Cactaceae *(n.pl.)* CB120
cactus *(n.)* CB121
caecum *(n.)* MF047
calcaneum *(n.)* CK114
calcareous *(adj.)* CN026
calcicole *(n.)* GA174
calciferol *(n.)* MH047
calciferous *(adj.)* CK216
calcific *(adj.)* CK217
calcification *(n.)* CN041
calcified cartilage *(n.)* CN031
calcifuge *(n.)* GA175
calcify *(v.)* CK215
calcined *(adj.)* BB065
calf *(n.)* CJ076
calibrate *(v.t.)* AQ011
calliper *(n.)* EA004
callose *(n.)* CS012

callus[1] *(n.)* (Bio) CS083
callus[2] *(n.)* (Bio) PB025
calorimetry *(n.)* LB039
calycle *(n.)* SF070
calyculus *(n.)* SF071
calyptra *(n.)* CH115
calyptrogen *(n.)* CS049
calyx *(n.)* SF035
cambium *(n.)* CS093
camera *(n.)* ND083
campanulate *(adj.)* CG140
campylotropous *(adj.)* SO080
canal *(n.)* AC067
canaliculus[1] *(n.)* (Bio, Ch, Ph) AC068
canaliculus[2] *(n.)* (Bio) CN067
canal rays *(n.pl.)* NE026
cancer *(n.)* JC175
candela *(n.)* KG020
canine *(n.)* ME079
capacitance *(n.)* QC040
capacitative *(adj.)* QC041
capacitative reactance *(n.)* NL041
capacitor *(n.)* QC036
capacity *(n.)* QA003
capillarity *(n.)* ED034
capillary[1] *(adj.)* (Bio) CG096
capillary[2] *(n.)* (Bio) PA015
capillary attraction *(n.)* ED038
capillary depression *(n.)* ED037
capillary rise *(n.)* ED036
capillary tube *(n.)* ED035
capillary water *(n.)* FH061
capillitium *(n.)* SC052
capitulum[1] *(n.)* (Bio) CG307
capitulum[2] *(n.)* (Bio) SF098
capsular *(adj.)* CE174
capsule[1] *(n.)* (Bio) CG274
capsule[2] *(n.)* (Bio) CE155
carapace *(n.)* CK210
carbohydrate[1] *(n.)* (Ch) BD099
carbohydrate[2] *(n.)* (Bio) MH002
carbonate *(n.)* BD032
carbonated *(adj.)* KA026
carbon microphone *(n.)* NK039
carboxylic acid *(n.)* BD082
carcerulus *(n.)* CE162
carcinogen *(n.)* JC178
carcinoma *(n.)* JC176
cardiac muscle *(n.)* CP055
cardinal sinuses *(n.pl.)* PA031
cardinal veins *(n.pl.)* PA029
carina *(n.)* CK161
carinates *(n.pl.)* CC179
carnassial *(n.)* ME082
Carnivora *(n.pl.)* CC209
carnivore *(n.)* MB010
carotene *(n.)* MC010
carotenoid *(n.)* MC009
carotid artery *(n.)* PA070
carotin *(n.)* MC012
carotinoid *(n.)* MC013
carp AL180
carpal bones *(n.pl.)* CK101
carpals *(n.pl.)* CK100
carpel *(n.)* SF118
carpellate *(adj.)* SF131
carpogonium *(n.)* SB142
carpospore *(n.)* SB143
carpus *(n.)* CK099
carriage *(n.)* AF047
carrier[1] *(n.)* (Bio) JC020
carrier[2] *(n.)* (Bio, Ch) KC004
carrier[3] *(n.)* (Ch) AF049
carrier wave *(n.)* NM008
carry *(v.t.)* AF021
carry out *(v.t.)* AQ012
cartilage *(n.)* CN029
cartilage bone *(n.)* CN048
cartilage cell *(n.)* CN037
cartilaginous *(adj.)* CN043
caruncle *(n.)* SD102
cary AL155
caryopsis *(n.)* CE154
casing *(n.)* NA056
Casparian strip *(n.)* CS091
cast[1] *(v.t.)* (Bio) CF036
cast[2] *(v.)* (Bio) SG029
caste *(n.)* GA037
castrate *(v.t.)* SB061
cata- *(pre.)* AL023
catabolism *(n.)* MA003
catalase *(n.)* MA040
catalyst *(n.)* UA002
cataphoresis *(n.)* DE033
Catarrhines *(n.pl.)* CC213
catcher *(n.)* NC041
category *(n.)* AP039
catenation *(n.)* DA024
cathepsin *(n.)* MA082
cathode *(n.)* EG017
cathode glow *(n.)* NE014
cathode-ray oscilloscope *(n.)* NE033
cathode rays *(n.pl.)* NE029
cathode-ray tube *(n.)* NE030
cathodic *(adj.)* EG034
cathodic reduction *(n.)* EG028
cation *(n.)* EG038
cationic *(adj.)* EG043
catkin *(n.)* SF096
cat's whisker *(n.)* NM083
caud AL175
cauda *(n.)* CF100
caudal *(adj.)* CG008
caudal fin *(n.)* CF104
caudate *(adj.)* CF114
caudex *(n.)* CH072
caul[1] *(n.)* (Bio) SJ007
caul[2] (Bio, Ch, Ph) AL182
cauliflory *(n.)* SF105
cauline *(adj.)* CH095
caulome *(n.)* CE023
caulotaxis *(n.)* CE004
causative agent *(n.)* JC057
cause *(v.t.)* AD001
caustic *(adj.)* BC027
caval veins *(n.pl.)* PA024
cavity *(n.)* CG270
cavity magnetron *(n.)* NC036
cavity resonator *(n.)* NC042
cell *(n.)* CT017
cell constant *(n.)* EG012
cell division *(n.)* CU001
cell respiration *(n.)* MJ010
cell sap *(n.)* CT082
cellular *(adj.)* CT011
cellulase *(n.)* MA070
cellulose *(n.)* CS001

cell wall *(n.)* CT032
Celsius scale *(n.)* LA004
cement *(n.)* ME071
censer mechanism *(n.)* CE170
cent- *(pre.)* AL057
Centigrade scale *(n.)* LA005
central *(n.)* CK078
central canal *(n.)* HB099
central inhibition *(n.)* HA028
central nervous system *(n.)* HB005
centre of buoyancy *(n.)* KF019
centre of curvature *(n.)* ND028
centre of gravity *(n.)* EB056
centre of inertia *(n.)* EB057
centre of mass *(n.)* EB055
centre of ossification *(n.)* CN077
centre of suspension *(n.)* NB120
centrifugal *(adj.)* EC032
centrifugal force *(n.)* EC014
centrifuge *(n.)* EC026
centriole *(n.)* CU043
centripetal *(adj.)* EC031
centripetal acceleration *(n.)* EC015
centripetal force *(n.)* EC013
centrolecithal *(adj.)* SH104
centromere *(n.)* CU021
centrosome *(n.)* CT065
centrum *(n.)* CK019
cephalic *(adj.)* CG004
Cephalochordata *(n.pl.)* CC124
Cephalopoda *(n.pl.)* CC107
cephalothorax *(n.)* CK191
cercaria *(n.)* SD048
cercus *(n.)* CF119
cereal *(n.)* MH008
cerebellar *(adj.)* HB110
cerebellum *(n.)* HB108
cerebral *(adj.)* HB090
cerebral cortex *(n.)* HB140
cerebral fissures *(n.pl.)* HB150
cerebral hemispheres *(n.pl.)* HB137
cerebral lobe *(n.)* HB148
cerebral medulla *(n.)* HB141
cerebral peduncle *(n.)* HB114
cerebrospinal *(adj.)* HB091
cerebrospinal fluid *(n.)* HB081
cerebrospinal ganglion *(n.)* HB050
cerebrum *(n.)* HB134
certain *(adj.)* AN061
cervical *(adj.)* CK163
cervical flexure *(n.)* SH072
cervix[1] *(n.)* (Bio) CG198
cervix[2] *(n.)* (Bio) SE041
Cestoda *(n.pl.)* CC023
Cetacea *(n.pl.)* CC205
chaeta *(n.)* CF050
chaetal *(adj.)* CF055
chaetiferous *(adj.)* CF056
Chaetopoda *(n.pl.)* CC044
chafing *(n.)* JC122
chain *(n.)* BD064
chalaza[1] *(n.)* (Bio) SD071
chalaza[2] *(n.)* (Bio) SH088
chalk *(n.)* FH027
chamber *(n.)* CG271
change[1] *(v.t.)* (Bio, Ch, Ph) AF065
change[2] *(v.i.)* (Bio, Ch, Ph) AF080
change of state *(n.)* EE032
channel *(n.)* AC066
chaos *(n.)* AM055
char *(v.t.)* AD060
characteristic[1] *(n.)* (Bio) AC008
characteristic[2] *(adj.)* (Bio, Ch, Ph) AC027
characteristics *(n.pl.)* NL022
charge density *(n.)* QC003
Charles' law *(n.)* EE008
Charophyta *(n.pl.)* CB034
chase *(v.t.)* FC016
cheek[1] *(n.)* (Bio) CJ080
cheek[2] *(n.)* (Bio) ME026
chela *(n.)* CK206
chelicera *(n.)* CK205
Chelonia *(n.pl.)* CC163
chemical[1] *(adj.)* (Bio, Ch, Ph) AB072
chemical[2] *(adj.)* (Ch) BC059
chemical[3] *(n.)* (Ch,) BC005
chemical bond *(n.)* DA001
chemical energy *(n.)* LC001
chemical hygrometer *(n.)* EE069
chemical potential *(n.)* UA001
chemical reaction *(n.)* BB071
chemical structure *(n.)* BC039
chemical technique *(n.)* BB001
chemiluminescence *(n.)* ND016
chemisorption *(n.)* BF005
chemokinesis *(n.)* FD045
chemolithotrophic *(adj.)* MB030
chemonasty *(n.)* FD054
chemo-organotrophic *(adj.)* MB029
chemoreceptor *(n.)* HE003
chemotaxis *(n.)* FD006
chemotrophic *(adj.)* MB026
chemotropism *(n.)* FD029
chew *(v.)* ME097
chiasma *(n.)* CU057
chiasmata *(n.pl.)* CU060
childhood *(n.)* FA053
Chilopoda *(n.pl.)* CC055
chimaera[1] *(n.)* (Bio) GB074
chimaera[2] *(n.)* (Bio) SB047
chimera *(n.)* GB075
Chiroptera *(n.pl.)* CC201
chitin *(n.)* CN020
chitinous *(adj.)* CN028
chlamydate *(adj.)* CG268
chloragen cell *(n.)* FF008
chloragogen cell *(n.)* FF011
chloride *(n.)* BD022
chlorination *(n.)* KA015
chloro- *(pre.)* AL089
chlorocruorin *(n.)* CR030
Chlorophyceae *(n.pl.)* CB023
chlorophyll *(n.)* MC002
Chlorophyta *(n.pl.)* CB022
chloroplast *(n.)* CT077
chlorosis *(n.)* MC004
chlorotic *(adj.)* MC008
choana *(n.)* HE017
Choanata *(n.pl.)* CC122
Choanichthyes *(n.pl.)* CC148
choanocyte *(n.)* CU073
choke *(n.)* NK069
choking *(adj.)* HE011
cholecalciferol *(n.)* MH048
cholesterol *(n.)* MD029
cholinergic *(adj.)* HB171
cholinesterase *(n.)* MA052
chondr AL157

chondral *(adj.)* CN044
Chondrichthyes *(n.pl.)* CC143
chondrin *(n.)* CN022
chondroblast *(n.)* CN038
chondroclast *(n.)* CN039
chondrocyte *(n.)* CN036
chondrogenesis *(n.)* CN040
chordae tendineae *(n.pl.)* PA055
chorda-mesoderm *(n.)* SH068
Chordata *(n.pl.)* CC119
chordate *(n.)* CK006
chorioid coat *(n.)* HC044
chorioid membrane *(n.)* HC043
chorioid plexus *(n.)* HB083
chorion *(n.)* SH075
choroid *(n.)* HC042
choroid plexus *(n.)* HB082
chrom- *(pre.)* AL087
chromatic *(adj.)* NH116
chromatid *(n.)* CU018
chromatin *(n.)* CT044
chromatogram *(n.)* EF017
chromatography *(n.)* EF008
chromatophore *(n.)* CT076
chromatoplate *(n.)* EF016
chromomere *(n.)* CU020
chromoplast *(n.)* CT075
chromosomal aberrations *(n.pl.)* TC039
chromosome *(n.)* CU017
chromosome map *(n.)* TC007
chromosome number *(n.)* CU025
chron- *(pre.)* AL076
chronic *(adj.)* JC040
chronometer *(n.)* KG002
chronon *(n.)* KG006
chrysalis *(n.)* SG021
Chrysophyta *(n.pl.)* CB025
chyle *(n.)* MG009
chyme *(n.)* MG010
chymotrypsin *(n.)* MA080
cicatrix *(n.)* JC099
cigar-shaped *(adj.)* CG142
cilia *(n.pl.)* CD012
ciliary *(adj.)* CD019
ciliary body *(n.)* HC072
ciliary muscle *(n.)* HC074
ciliary processes *(n.pl.)* HC073
Ciliata *(n.pl.)* CA065
ciliate[1] *(n.)* (Bio) CA067
ciliate[2] *(adj.)* (Bio) CD020
ciliated *(adj.)* CD021
ciliated epithelium *(n.)* CM010
Ciliophora *(n.pl.)* CA064
cilium *(n.)* CD010
circadian rhythm *(n.)* FD062
circinnate *(adj.)* CE066
circuit *(n.)* NJ055
circular *(adj.)* EA014
circular polarization *(n.)* NB071
circulate *(v.)* AG093
circulation *(n.)* NH020
circulatory system *(n.)* PA035
circum- *(pre.)* AL036
circumduction *(n.)* FB049
circumference *(n.)* CG113
circumnutation *(n.)* CH090
circumscissile *(adj.)* CE177
circumstances *(n.pl.)* AA043
cis- *(pre.)* AL012
cis-arrangement *(n.)* TC046
cis-trans effect *(n.)* TC045
cistron *(n.)* TC006
citric acid *(n.)* MA018
citric acid cycle *(n.)* MA017
cladode *(n.)* CH073
clarify *(v.t.)* AM029
-clasis *(suff.)* AL127
clasper *(n.)* SE014
class[1] *(n.)* (Bio, Ch, Ph) AP040
class[2] *(n.)* (Bio) CA009
classification[1] *(n.)* (Bio, Ch, Ph) AP038
classification[2] *(n.)* (Bio) CA015
classify *(v.t.)* AP047
-clast *(suff.)* AL127
clavicle *(n.)* CK143
claw *(n.)* CF014
clay *(n.)* FH029
clean *(adj.)* JD017
cleanliness *(n.)* JD002
cleanse *(v.t.)* JD012
clear[1] *(adj.)* (Bio, Ch, Ph) AC037
clear[2] *(adj.)* (Bio, Ch, Ph) AK032
cleavage *(n.)* SH007
cleavage plane *(n.)* BG007
cleave *(v.)* AG071
cleft *(n.)* AA086
cleidoic *(adj.)* SH113
climax *(n.)* GA126
climbing stem *(n.)* CH070
cline *(n.)* GA039
clinic *(n.)* JC137
clinical *(adj.)* JC168
clinical analysis *(n.)* JC145
clinical disease *(n.)* JC008
clinical thermometer[1] *(n.)* (Ph) LA045
clinical thermometer[2] *(n.)* (Bio) JC146
clinician *(n.)* JC138
clinker *(n.)* BB089
clisere *(n.)* GA162
clitellum *(n.)* SE012
clitoris *(n.)* SE040
cloaca *(n.)* MF043
cloacal *(adj.)* MF053
cloacal aperture *(n.)* MF046
clock *(n.)* KG001
clockwise *(adj.)* KD054
clone *(n.)* GB029
closed bundle *(n.)* PB009
closed circuit *(n.)* NJ064
clot *(n.)* CR069
cloud *(n.)* EE064
cloud chamber *(n.)* NF027
club fungi *(n.pl.)* CB057
club-shaped *(adj.)* CG147
clump[1] *(n.)* (Bio) JB004
clump[2] *(v.)* (Bio) JB025
clump[3] *(n.)* (Bio) AA071
cluster *(n.)* AA069
clutch *(n.)* SH093
Cnidaria *(n.pl.)* CC007
cnidoblast *(n.)* CU076
cnidocil *(n.)* CU078
C.N.S. (central nervous system) *(n.)* HB005
co- *(pre.)* AL031
coagulate[1] *(v.)* (Ch) DE038
coagulate[2] *(v.i.)* (Bio) CR075
coagulation *(n.)* DE036

coalesce *(v.i.)* AA077
coarctate *(adj.)* SG034
coarse[1] *(adj.)* (Bio, Ch, Ph) AB034
coarse[2] *(adj.)* (Bio, Ch, Ph) AN027
coat[1] *(v.t.)* (Ch) BB116
coat[2] *(n.)* (Bio) CG251
coating *(n.)* CG256
coaxial cable *(n.)* NK101
cobalamin *(n.)* MH065
coccus *(n.)* JC059
coccyx *(n.)* CK016
cochlea *(n.)* HD065
cochlear canal *(n.)* HD081
cochlear duct *(n.)* HD078
cocoon[1] *(n.)* (Bio) SG023
cocoon[2] *(n.)* (Bio) SG050
co-dominant *(adj.)* TC031
coefficient of absolute expansion of a liquid *(n.)* LA056
coefficient of apparent expansion of a liquid *(n.)* LA055
coefficient of cubical (volume) expansion *(n.)* LA051
coefficient of expansion of a gas at constant pressure *(n.)* EE010
coefficient of friction *(n.)* EC056
coefficient of kinetic friction *(n.)* EC057
coefficient of linear expansion *(n.)* LA047
coefficient of restitution *(n.)* KE020
coefficient of static friction *(n.)* EC058
coefficient of superficial expansion *(n.)* LA050
coefficient of viscosity *(n.)* EC074
coel AL150
Coelenterata *(n.pl.)* CC006
coelenterate *(n.)* CJ052
coelenteron *(n.)* CJ005
coeliac *(adj.)* CJ044
coelom *(n.)* CJ013
coelomate[1] *(adj.)* (Bio) CJ026
coelomate[2] *(n.)* (Bio) CJ053
coelomic *(adj.)* CJ025
coelomic corpuscles *(n.pl.)* CJ039
coelomic fluid *(n.)* CJ038
coelomic space *(n.)* CJ015
coelomoduct *(n.)* FF001
coeno- *(pre.)* AL032
coenobium *(n.)* GA034
coenocyte[1] *(n.)* (Bio) CL004
coenocyte[2] *(n.)* (Bio) CS030
coenogamete *(n.)* SB021
coenospecies *(n.)* CA023
coenzyme *(n.)* MA043
coercive force *(n.)* QB068
coercivity *(n.)* QB072
cog *(n.)* NA051
cog wheel *(n.)* NA050
cohere *(v.i.)* AD033
coherent *(adj.)* NB029
cohesion *(n.)* ED029
cohesion theory *(n.)* FH006
coil[1] *(n.)* (Bio, Ch, Ph) CG102
coil[2] *(n.)* (Ph) NJ052
coil ignition *(n.)* NK075
coinage metals *(n.pl.)* BD027
coition *(n.)* SB041
coitus *(n.)* SB042
cold cathode *(n.)* NE031
Coleoptera *(n.pl.)* CC072
coleoptile *(n.)* CH086
coleorhiza *(n.)* CH114
collagen *(n.)* CN014
collar *(n.)* CG117
collar-bone *(n.)* CK144
collateral *(adj.)* CG027
collateral bundle *(n.)* PB003
collect *(v.)* AQ022
collection *(n.)* AA072
collective *(adj.)* AE024
collector *(n.)* NM098
collector characteristics *(n.pl.)* NM107
collector diode *(n.)* NM100
collenchyma[1] *(n.)* (Bio) CS056
collenchyma[2] *(n.)* (Bio) CJ007
collide[1] *(v.i.)* (Bio, Ch, Ph) AG105
collide[2] *(v.i.)* (Ch, Ph) EB035
colligative properties *(n.)* DD038
collimator *(n.)* ND113
collision *(n.)* EB022
colloid *(n.)* DE017
colloidal state *(n.)* DE018
colloidal systems *(n.)* DE016
colon *(n.)* MF040
colonial *(adj.)* GA049
colonial animal *(n.)* A035
colony *(n.)* GA033
colostrum *(n.)* SE053
colour *(n.)* ND087
colour blindness *(n.)* HC085
coloured *(adj.)* AC035
colourless *(adj.)* AC036
colour mixing *(n.)* ND092
colour vision *(n.)* HC098
columella auris *(n.)* HD039
column[1] *(n.)* (Bio) CG115
column[2] *(n.)* (Bio) SF130
columnar *(adj.)* CG138
columnar epithelium *(n.)* CM009
column chromatography *(n.)* EF012
coma *(n.)* HB186
combat *(v.t.)* JC034
combination *(n.)* AA066
combination tone *(n.)* NH063
combine *(v.i.)* BB079
combined *(adj.)* BC014
commence *(v.)* AD024
commensalism *(n.)* GA115
comment *(v.i.)* AM025
commissure *(n.)* HB077
common *(adj.)* AM034
common-base circuit *(n.)* NM114
common-collector circuit *(n.)* NM116
common-emitter circuit *(n.)* NM115
commonly *(adv.)* AM035
community *(n.)* GA025
commutator *(n.)* NK093
compact bone *(n.)* CN046
companion cell *(n.)* PB023
comparable *(adj.)* AP035
comparator method *(n.)* LA062
compare *(v.t.)* AP019
compass *(n.)* QB049
compatible *(adj.)* JB031
compatibility *(n.)* JB023
compensate *(v.t.)* AJ025
compensation *(n.)* LA063

compensation depth *(n.)* GA194
compensation point *(n.)* GA021
compensatory hypertrophy *(n.)* FA026
competence *(n.)* SH055
complement *(n.)* JB045
complemental air *(n.)* MJ098
complementary colours *(n.pl.)* ND091
complementation *(n.)* TC048
complete *(adj.)* AN019
complete cleavage *(n.)* SH010
complete flower *(n.)* SF002
complete metamorphosis *(n.)* SG036
complete regeneration *(n.)* FA007
complex *(adj.)* AJ034
complex anion *(n.)* DF008
complex cation *(n.)* DF007
complex ion *(n.)* DF006
complicated *(adj.)* AJ035
component[1] *(n.)* (Ph) KD022
component[2] *(n.)* (Ph) NJ056
component[3] *(n.)* (Bio, Ch, Ph) AE005
composed of *(adj.)* AB032
composite fruit *(n.)* CE190
composition of forces *(n.)* KD019
compost *(n.)* GB046
compound[1] *(n.)* (Ch) BC041
compound[2] *(v.t.)* (Ph) NB100
compound eye *(n.)* HC027
compound fruit *(n.)* CE186
compound leaf *(n.)* CE119
compound pendulum *(n.)* NB118
compound umbel *(n.)* SF103
compound-wound *(adj.)* NK098
compound yellow *(n.)* ND094
compress *(v.t.)* KF033
compression *(n.)* NH008
comprise *(v.t.)* AE013
Compton effect *(n.)* NC081
computer *(n.)* NM125
concave *(adj.)* CG245
concave (negative) lens *(n.)* ND049
concave mirror *(n.)* ND024
concavity *(n.)* CG235
conceive *(v.i.)* SB034
concentrate[1] *(n.)* (Ch) BB097
concentrate[2] *(v.t.)* (Ch) DD026
concentrated *(adj.)* DD031
concentration *(n.)* DD007
concentric *(adj.)* AC058
concentric bundle *(n.)* PB005
concept *(n.)* AK011
conceptacle *(n.)* SF198
conception *(n.)* SB033
concerned with *(adj.)* AJ040
concha *(n.)* HE019
conchiolin *(n.)* CF064
conclude *(v.t.)* AD029
conclusion *(n.)* AM010
concrete *(adj.)* AM062
concurrent *(adj.)* KD042
concussion *(n.)* HB187
condensation[1] *(n.)* (Ch) EE037
condensation[2] *(n.)* (Ch) KA008
condensation polymer *(n.)* BH013
condense[1] *(v.)* (Ch, Ph) EE050
condense[2] *(v.)* (Ch) BH017
condensed film *(n.)* ED042
condenser *(n.)* NA040
condenser microphone *(n.)* NK040
condition *(n.)* AJ048
conditioned reflex *(n.)* HB156
conduct *(v.t.)* AF023
conductance[1] *(n.)* (Ph) NJ040
conductance[2] *(n.)* (Ch) EG001
conductance bridge *(n.)* EG013
conduction *(n.)* CG201
conduction band *(n.)* NM053
conductivity[1] *(n.)* (Ph) NJ041
conductivity[2] *(n.)* (Ch) EG002
conductivity cell *(n.)* EG011
conductor *(n.)* NJ004
condyle *(n.)* CG310
cone[1] *(n.)* (Bio) HC097
cone[2] *(n.)* (Bio) SD007
cone[3] *(n.)* (Bio) CG108
configuration *(n.)* AC011
confluence *(n.)* AA060
confluent *(adj.)* CG216
conform *(v.i.)* AP017
conformity *(n.)* AP009
confusion *(n.)* AM054
congeal *(v.i.)* CR076
congenital *(adj.)* CG350
congruence *(n.)* AP008
congruity *(n.)* AP007
conidiophore *(n.)* SC044
conidium *(n.)* SC018
conifer *(n.)* CB095
Coniferales *(n.pl.)* CB093
conjugant *(n.)* SB116
conjugate foci *(n.pl.)* ND031
conjugation *(n.)* SB115
conjugation canal *(n.)* SB118
conjugation tube *(n.)* SB117
conjunctiva *(n.)* HC047
conjunctivitis *(n.)* HC052
connate *(adj.)* CE113
connect[1] *(v.t.)* (Bio, Ch, Ph) AD032
connect[2] *(v.t.)* (Ch, Ph) NJ080
connection *(n.)* AA064
connective[1] *(adj.)* (Bio, Ch, Ph) AA079
connective[2] *(n.)* (Bio) SF158
connective tissue *(n.)* CN001
conscious *(adj.)* HB193
consciousness *(n.)* HB184
consecutive *(adj.)* AH038
consequence *(n.)* AJ054
consequent *(adj.)* QB030
conservation of momentum *(n.)* EB020
consist of *(v.i.)* AB023
consistency[1] *(n.)* (Bio, Ch, Ph) AN077
consistency[2] *(n.)* (Bio, Ch, Ph) AB045
consistent *(adj.)* AN087
consociation *(n.)* GA130
consonance *(n.)* NH101
constant[1] *(n.)* (Bio, Ch, Ph) AN072
constant[2] *(adj.)* (Bio, Ch, Ph) AN090
constant-volume gas thermometer *(n.)* LA029
constant-volume hydrogen thermometer *(n.)* LA030
constipation *(n.)* JC113
constituent[1] *(n.)* (Bio, Ch, Ph) AE007
constituent[2] *(n.)* (Ch) BC043
constituent[3] *(adj.)* (Bio, Ch, Ph) AE017
constitutive enzyme *(n.)* MA024
constrain *(v.t.)* EB033
constraining force *(n.)* EB002

constrict *(v.t.)* AG037
constriction *(n.)* CU012
constrictor *(n.)* FB058
consume[1] *(v.t.)* (Bio, Ch, Ph) AJ084
consume[2] *(v.t.)* (Bio) MH021
consumed *(adj.)* AD068
contact[1] *(n.)* (Bio, Ch, Ph) AD020
contact[2] *(n.)* (Ph) NJ051
contact e.m.f. *(n.)* NJ104
contact insecticide *(n.)* JD039
contact p.d. *(n.)* NJ105
contact process *(n.)* BB103
contagion *(n.)* JC018
contagious *(adj.)* JC047
contain *(v.t.)* AB024
contaminate *(v.t.)* JD029
contaminated[1] *(adj.)* (Ch) BB101
contaminated[2] *(adj.)* (Bio) JD035
contamination *(n.)* JD020
content *(n.)* AE011
continual *(adj.)* AH040
continually *(adv.)* AH042
continuous *(adj.)* AH039
continuously *(adv.)* AH041
continuous spectrum[1] *(n.)* (Ph) ND099
continuous spectrum[2] *(n.)* (Ch, Ph) NE060
continuous variation *(n.)* TA034
continuum *(n.)* EC041
contour *(n.)* GB011
contour feather *(n.)* CF087
contour ridging *(n.)* GB012
contra- *(pre.)* AL085
contract *(v.i.)* AG042
contractable *(adj.)* AG046
contractile *(adj.)* AG047
contractile vacuole *(n.)* FE011
contractility *(n.)* CP018
contradict *(v.t.)* AM079
contrary *(n.)* AM051
contrast[1] *(n.)* (Bio, Ch, Ph) AP003
contrast[2] *(v.)* (Bio, Ch, Ph) AP020
contrasting *(adj.)* AP031
control *(v.t.)* AJ023
control grid *(n.)* NL017
contusion *(n.)* JC085
conus arteriosus *(n.)* PA048
convection *(n.)* LB008
convection current *(n.)* LB009
convention *(n.)* AN069
converge *(v.)* AF004
convergence *(n.)* RA007
convergent *(adj.)* AF016
convergent evolution *(n.)* RA008
converging *(adj.)* ND067
converse *(n.)* AM050
convert *(v.t.)* AF066
convex *(adj.)* CG246
convexity *(n.)* CG236
convex lens *(n.)* ND050
convex mirror *(n.)* ND023
convey *(v.t.)* AF022
convoluted *(adj.)* CG160
convulsion *(n.)* JC116
cooling by evaporation *(n.)* EE061
coordinate bond *(n.)* DA005
coordination *(n.)* FG006
copious *(adj.)* AN133
coplanar *(adj.)* KD041
copolymer *(n.)* BH014
copolymerization *(n.)* BB125
copper losses *(n.pl.)* NK076
coprophagous *(adj.)* MH034
copulant *(n.)* SB119
copulation *(n.)* SB043
coracoid *(n.)* CK142
coracoid process *(n.)* CK148
coral *(n.)* CC019
cord *(n.)* KD032
cordate *(adj.)* CE104
core[1] *(n.)* (Bio, Ph) CG168
core[2] *(n.)* (Ph) NK045
cork *(n.)* CS086
cork-cambium *(n.)* CS087
corm *(n.)* SC067
cormophyte *(n.)* CH003
cornea *(n.)* HC041
cornification *(n.)* CN025
cornified layer *(n.)* CF029
corolla *(n.)* SF038
corollaceous *(adj.)* SF052
corolla tube *(n.)* SF040
corolliferous *(adj.)* SF053
corona *(n.)* CG077
corona discharge *(n.)* QC014
coronal *(adj.)* CG085
coronal plane *(n.)* CG038
coronary *(adj.)* CG084
corpora allata *(n.pl.)* JA011
corpora quadrigemina *(n.pl.)* HB113
corpus *(n.)* CS044
corpus adiposum *(n.)* FF014
corpus allatum *(n.)* JA010
corpus callosum *(n.)* HB144
corpuscle *(n.)* CG062
corpus luteum *(n.)* SB096
corpus striatum *(n.)* HB146
correct[1] *(adj.)* (Bio, Ch, Ph) AN023
correct[2] *(v.t.)* (Bio, Ch, Ph) AN015
correction *(n.)* AN011
correspond *(v.i.)* AP014
correspondence *(n.)* AP006
corresponding states *(n.pl.)* EE027
corrode[1] *(v.)* (Ph) BF017
corrode[2] *(v.)* (Ch) KA059
corrosion *(n.)* BF015
corrosive *(adj.)* BC030
cortex[1] *(n.)* (Bio) CG169
cortex[2] *(n.)* (Bio) FF019
cortex[3] *(n.)* (Bio) CH032
cortical *(adj.)* CG180
corticate *(adj.)* CG181
cortisone *(n.)* JA021
Corti's organ *(n.)* HD080
corymb *(n.)* SF093
cosmic rays *(n.pl.)* NC044
cosmoid scale *(n.)* CF008
costaeform *(adj.)* CE090
costal *(adj.)* CK055
costate *(adj.)* CE087
cotyledon *(n.)* SD105
cough *(n.)* JC111
coulomb *(n.)* KG029
Coulomb's law *(n.)* QC004
counter- *(pre.)* AL029
countercurrent distribution *(n.)* EF004
counterpoise *(n.)* AQ009
couple[1] *(v.t.)* (Bio, Ch, Ph) AA075

couple[2] *(n.)* (Ph) KD024
coupled *(adj.)* NL062
coupled systems *(n.pl.)* NH016
course *(n.)* AA015
courtship *(n.)* SG055
covalency *(n.)* DC015
covalent *(adj.)* BD038
covalent bond *(n.)* DA004
covalent lattice *(n.)* DC003
cover crop *(n.)* GB015
covert *(n.)* CF090
coxa *(n.)* CK200
coxal *(adj.)* CK181
crack *(n.)* AA083
cracking *(n.)* BB120
cranial *(adj.)* CG005
cranial flexure *(n.)* SH071
cranial nerve *(n.)* HB023
Craniata *(n.pl.)* CC131
cranium *(n.)* CK057
crank *(n.)* NA045
crankshaft *(n.)* NA046
creeper *(n.)* CE003
cremocarp *(n.)* CE161
crenate *(adj.)* CE095
crescent *(n.)* CG106
crest[1] *(n.)* (Bio) CG306
crest[2] *(n.)* (Ph) NB006
cretinism *(n.)* JA037
crevice *(n.)* AA085
cricoid *(adj.)* CG139
criss-cross *(n.)* TA030
crista[1] *(n.)* (Bio) CT061
crista[2] *(n.)* (Bio) HD062
crista acustica *(n.)* HD064
criterion *(n.)* AM049
critical *(adj.)* AN065
critical angle *(n.)* ND045
critical constants *(n.)* EE023
critical density *(n.)* EE022
critical frequency *(n.)* NL047
critical isothermal *(n.)* EE025
critical point *(n.)* EE024
critical pressure *(n.)* EE020
critical temperature *(n.)* EE019
critical volume *(n.)* EE021
CRO *(abbr.)* NE035
Crocodilia *(n.pl.)* CC165
Crookes dark space *(n.)* NE013
crop[1] *(n.)* (Bio) GB034
crop[2] *(n.)* (Bio) MF012
crop milk *(n.)* SG059
crop rotation *(n.)* GB003
cross[1] *(n.)* (Bio) TA029
cross[2] *(v.t.)* (Bio) TA037
cross-fertilization *(n.)* SB031
crossing-over[1] *(n.)* (Bio) CU058
crossing-over[2] *(n.)* (Bio) TC044
Crossoptergyii *(n.pl.)* CC149
cross-over value *(n.)* TC063
cross-pollination *(n.)* SD082
cross-section *(n.)* KD031
crouch *(v.i.)* FB016
crown *(n.)* ME064
CRT *(abbr.)* NE034
cruciform *(adj.)* CG127
crude *(adj.)* AJ038
crumb *(n.)* AB016
crumble *(v.)* AB020
crumbled *(adj.)* AB055
crumb structure *(n.)* FH053
crumple *(v.)* CG240
crunch *(v.t.)* ME099
crura cerebri *(n.pl.)* HB115
crush *(v.)* ME098
Crustacea *(n.pl.)* CC057
crustacean *(n.)* CC064
crustose *(adj.)* CB075
cryophyte *(n.)* GA136
cryostat *(n.)* LA039
cryptic coloration *(n.)* GA090
Cryptogamia *(n.pl.)* CB016
cryptozoic *(adj.)* GA098
crypts *(n.pl.)* SJ005
crystal *(n.)* BG010
crystal chemistry *(n.)* BG019
crystal face *(n.)* BG006
crystal grain *(n.)* BG017
crystal lattice *(n.)* BG003
crystalline *(adj.)* BG023
crystalline lens *(n.)* HC071
crystallization *(n.)* BG015
crystallize *(v.)* BG021
crystalloid[1] *(n.)* (Bio, Ch, Ph) BG020
crystalloid[2] *(adj.)* (Bio, Ch, Ph) BG024
crystal microphone *(n.)* NK043
crystal nucleus *(n.)* BG016
crystal rectifier *(n.)* NM081
crystal structure *(n.)* BG001
crystal symmetry *(n.)* BG005
crystal systems *(n.pl.)* BG004
ctene *(n.)* FC011
ctenidium *(n.)* MJ058
Ctenophora *(n.pl.)* CC016
cubical epithelium *(n.)* CM011
cud *(n.)* MG012
cultivate *(v.t.)* GB056
cultivated *(adj.)* GB057
culture[1] *(n.)* (Bio) CD027
culture[2] *(v.t.)* (Bio) CD032
cupula *(n.)* HD063
cure[1] *(n.)* (Bio) JC011
cure[2] *(v.t.)* (Bio) JC036
curie *(n.)* NF019
Curie point *(n.)* QB017
Curie's law *(n.)* QB071
current *(n.)* EC069
current balance *(n.)* NJ025
current cycle *(n.)* NJ020
current electricity *(n.)* NJ016
current gain *(n.)* NM111
curtail *(v.t.)* AG036
cusp *(n.)* ME086
cut *(v.t.)* AG068
cutaneous *(adj.)* CF018
cuticle[1] *(n.)* (Bio) CS079
cuticle[2] *(n.)* (Bio) CG152
cuticularization[1] *(n.)* (Bio) CS081
cuticularization[2] *(n.)* (Bio) CG154
cuticulin *(n.)* CF067
cutin *(n.)* CS007
cutinization *(n.)* CS080
cut-off frequency[1] *(n.)* (Ph) NL048
cut-off frequency[2] *(n.)* (Ph) NL076
cut-out *(n.)* NJ069
cutting *(n.)* GB062
cyanocobalamin *(n.)* MH078
Cyanophyceae *(n.pl.)* CB019

Cyanophyta *(n.pl.)* CB018
cycad *(n.)* CB096
Cycadales *(n.pl.)* CB094
cycle *(n.)* KA058
cyclic *(adj.)* BD071
cyclize *(v.)* KA039
cyclosis *(n.)* CT002
Cyclostomata *(n.pl.)* CC134
cyclotron *(n.)* NE049
cylinder *(n.)* NA042
cylindrical *(adj.)* AC070
cyme *(n.)* SF099
cymose *(adj.)* SF110
cypsela *(n.)* CE153
cyst[1] *(n.)* (Bio) CG275
cyst[2] *(n.)* (Bio) CA046
cystic *(adj.)* CA050
cystic duct *(n.)* MA114
cysticercoid *(n.)* SD056
cysticercus *(n.)* SD055
cystoid *(adj.)* CA052
cystolith *(n.)* CS020
cystous *(adj.)* CA051
cyt AL159
cytochrome *(n.)* CR028
cytodeme *(n.)* CA028
cytokinesis *(n.)* CU011
cytokinins *(n.pl.)* JA081
cytological *(adj.)* CT015
cytology *(n.)* CT001
cytolysin *(n.)* CT006
cytolysis *(n.)* CT005
cyton *(n.)* CQ017
cytoplasm *(n.)* CT019
cytostome *(n.)* ME003

dabble *(v.i.)* ME052
dactyl AL173
dairy farming *(n.)* GB021
dairy products *(n.pl.)* MH012
Dalton's law *(n.)* EE009
damage *(v.t.)* AG113
damped *(adj.)* NB108
damping[1] *(n.)* NB091
damping[2] *(n.)* NH019
Daniell cell *(n.)* EG056
Daniell hygrometer *(n.)* EE072
dark adaptation *(n.)* HC036
dark reaction *(n.)* MC006
Darwinism *(n.)* RA002
data *(n.pl.)* NM126
dative bond *(n.)* DA007
dative covalent bond *(n.)* DA006
daughter *(n.)* SA003
daughter chromosome *(n.)* CU019
d-block elements *(n.pl.)* BD048
d.c. *(abbr.)* NJ018
D.D.T. *(abbr.)* JD041
Deacon process *(n.)* BB105
deactivation *(n.)* EF022
dead *(adj.)* NH042
dead-beat *(adj.)* NB112
dead space *(n.)* LA035
deamination *(n.)* MA092
death point *(n.)* FE029
debris *(n.)* MB006
de Broglie's equation *(n.)* NC087
Debye unit *(n.)* QC044
dec- *(pre.)* AL056
deca- *(pre.)* AL049
decant *(v.t.)* BB045
decantation *(n.)* BB013
Decapoda[1] *(n.pl.)* (Bio) CC059
Decapoda[2] *(n.pl.)* (Bio) CC110
decay[1] *(n.)* (Bio) FG015
decay[2] *(n.)* (Bio) MA013
deceleration *(n.)* EA028
decibel *(n.)* NH060
decidua *(n.)* SJ004
deciduate *(adj.)* SJ029
deciduous *(adj.)* CE035
deciduous teeth *(n.pl.)* ME063
decline[1] *(v.i.)* (Bio, Ch, Ph) AF006
decline[2] *(v.i.)* (Bio, Ch, Ph) AG121
decolorize *(v.t.)* BA011
decompose *(v.)* KA036
decomposition *(n.)* KA027
decomposition voltage *(n.)* EG024
decrease[1] *(v.t.)* (Bio, Ch, Ph) AG031
decrease[2] *(v.i.)* (Bio, Ch, Ph) AG040
decrease[3] *(n.)* (Bio, Ch, Ph) AN042
decrement *(n.)* AN043
decumbent *(adj.)* CH096
decurrent *(adj.)* CE065
decussate *(adj.)* CE061
deduce *(v.t.)* AM028
deduction *(n.)* AM008
deep *(adj.)* CG243
defaecate *(v.i.)* MG029
defaecation *(n.)* MG016
defect *(n.)* AC048
defective *(adj.)* TC027
deficiency *(n.)* AC051
deficiency disease *(n.)* JC179
deficient *(adj.)* AN141
define *(v.t.)* AM074
definition *(n.)* AM073
deflate *(v.)* AG038
deflect *(v.t)* AF008
defoliant *(n.)* CE012
defoliation *(n.)* CE011
deform *(v.t.)* AC020
deformability *(n.)* AC006
deformation *(n.)* AC003
deformed *(adj.)* AC032
deformity *(n.)* AC005
degaussing *(n.)* QB066
degeneracy *(n.)* AG124
degenerate[1] *(v.i.)* (Bio, Ch, Ph) AG120
degenerate[2] *(adj.)* (Bio, Ch, Ph) AG131
degenerate[3] *(v.i.)* (Bio) CJ056
degeneration *(n.)* AG123
degenerative *(adj.)* AG130
degenerative disease *(n.)* JC174
deglutition *(n.)* ME141
degrade *(v.t.)* AG117
degree of ionization *(n.)* DF003
dehiscent *(adj.)* CE171
dehydrate *(v.t.)* KA022
dehydration *(n.)* KA007
dehydrogenase *(n.)* MA035
dehydrogenation *(n.)* KA006
deionize *(v.t.)* DD028
deka- *(pre.)* AL049
deleterious *(adj.)* TC025
deletion *(n.)* TC040
delicate *(adj.)* CG095
delocalized bond *(n.)* DA030

demagnetize *(v.t.)* QB022
deme *(n.)* CA026
demersal *(adj.)* GA201
demodulation *(n.)* NM016
demodulator *(n.)* NM039
demography *(n.)* GA009
demonstrate *(v.t.)* AQ013
dendrite *(n.)* CQ013
dendron *(n.)* CQ012
dense[1] *(adj.)* (Ch) BA030
dense[2] *(adj.)* (Bio, Ch, Ph) AN134
density[1] *(n.)* (Ph) KF002
density[2] *(n.)* (Ch, Ph) BA026
dental *(adj.)* ME102
dental formula *(n.)* ME089
dentate[1] *(adj.)* (Bio) ME103
dentate[2] *(adj.)* (Bio) CE093
denticle *(n.)* ME084
denticulated *(adj.)* CE098
dentine *(n.)* ME069
dentist *(n.)* ME091
dentistry *(n.)* ME090
dentition *(n.)* ME088
denture *(n.)* ME092
deoxyribonucleic acid *(n.)* TB012
dependent *(adj.)* AN098
dependent differentiation *(n.)* SH057
dependent variable *(n.)* AN076
depend on/upon *(v.t.)* AP013
deplete *(v.t.)* AJ085
depletion layer *(n.)* NM068
depressor *(n.)* FB055
derivative *(n.)* KA021
derive[1] *(v.t.)* (Bio, Ch, Ph) AJ014
derive[2] *(v.t.)* (Ch) KA023
derive[3] *(v.)* (Bio, Ch, Ph) AF097
derived quantities *(n.pl.)* AN034
derived units *(n.pl.)* KG044
derm AL158
Dermaptera *(n.pl.)* CC082
dermatitis *(n.)* CF033
dermatogen *(n.)* CS047
dermatosis *(n.)* CF034
dermis *(n.)* CF024
descendant *(n.)* SA010
desquamated *(adj.)* CF020
destroy *(v.t.)* AG118
destructible *(adj.)* AG127
destructive *(adj.)* AG129
destructive distillation *(n.)* BB023
detail *(n.)* AE004
detect *(v.t.)* AQ027
detector *(n.)* NM040
detergent *(n.)* BF009
deteriorate *(v.i.)* AG119
determination[1] *(n.)* (Bio, Ch, Ph) AN110
determination[2] *(n.)* (Bio) SH054
determine *(v.t.)* AN114
detoxication *(n.)* MA100
detriment *(n.)* AG122
detrimental *(adj.)* AG126
detumescence *(n.)* SE032
Deuteromycetes *(n.pl.)* CB059
develop[1] *(v.i.)* (Bio, Ch, Ph) AD043
develop[2] *(v.)* (Bio, Ch, Ph) AG016
development[1] *(n.)* (Bio) FA002
development[2] *(n.)* (Ch) EF018
deviate[1] *(v.i.)* (Bio, Ch, Ph) AF002
deviate[2] *(v.t.)* (Bio, Ch, Ph) AF007
deviation *(n.)* ND064
device *(n.)* AQ007
dew *(n.)* EE059
dew point *(n.)* EE060
dew-point hygrometer *(n.)* EE071
dextrin *(n.)* MD037
dextrorotatory *(adj.)* NB087
dextrose *(n.)* MD044
di- *(pre.)* AL043
dia- *(pre.)* AL019
diabetes *(n.)* MA130
diabetes insipidus *(n.)* MA132
diabetes mellitus *(n.)* MA131
diadelphous *(adj.)* SF177
diageotropism *(n.)* FD039
diagnose *(v.t.)* JC165
diagnosis *(n.)* JC144
diagram *(n.)* AQ031
diakinesis *(n.)* CU066
dialysis *(n.)* DE035
diamagnetic *(adj.)* NK019
diameter *(n.)* CG111
diandrous *(adj.)* SF173
diapause *(n.)* FA019
diaphragm[1] *(n.)* (Bio) MJ082
diaphragm[2] *(n.)* (Ph) NK037
diaphysis *(n.)* CN078
diapsid *(adj.)* CC173
Diapsida *(n.pl.)* CC166
diarrhoea *(n.)* JC112
diastema *(n.)* ME083
diaster *(n.)* CU047
diastole *(n.)* PA060
diathermanous *(adj.)* LB027
diatom *(n.)* CB033
diatonic *(adj.)* NH115
diatonic scale *(n.)* NH095
Dibranchiata *(n.pl.)* CC108
dichasial *(adj.)* SF112
dichasium *(n.)* SF101
dichlamydeous *(adj.)* SF050
dichogamy *(n.)* SA031
dichotomous *(adj.)* CG178
diclinous *(adj.)* SF033
dicotyledon *(n.)* CB107
Dicotyledoneae *(n.pl.)* CB106
dicotyledonous *(adj.)* SD113
Dictyoptera *(n.pl.)* CC086
dictyostele *(n.)* CH054
didynamous *(adj.)* SF168
die away *(v.i.)* NB101
die-away curve *(n.)* NB092
dielectric *(n.)* QC025
dielectric constant *(n.)* QC034
dielectric fatigue *(n.)* QC028
dielectric heating *(n.)* QC029
dielectric loss *(n.)* QC026
dielectric strength *(n.)* QC027
dielectrophoresis *(n.)* QC050
diencephalon *(n.)* HB071
diesel engine *(n.)* NA030
diet *(n.)* MH001
dietetics *(n.sing.)* MH016
difference tone *(n.)* NH065
different *(adj.)* AP027
differential *(adj.)* NA025
differentially permeable *(adj.)* AF147
differential pulley *(n.)* NA020

differentiation[1] *(n.)* (Bio) CT007
differentiation[2] *(n.)* (Bio) CL007
diffraction[1] *(n.)* (Ph) NB043
diffraction[2] *(n.)* (Ph) NH030
diffraction grating *(n.)* NB046
diffuse[1] *(v.)* (Bio, Ch, Ph) AG091
diffuse[2] *(adj.)* (Ph) ND038
diffusion *(n.)* ED007
diffusion pressure deficit *(n.)* FH003
digastric *(adj.)* FB061
digestible *(adj.)* MG031
digestion *(n.)* MG001
digestive *(adj.)* MG030
digit *(n.)* CK074
digitate *(adj.)* CE130
digitigrade *(adj.)* FC022
dihybrid *(n.)* TA028
dilatancy *(n.)* EC080
dilate[1] *(v.t.)* (Bio, Ch, Ph) AG003
dilate[2] *(v.i.)* (Bio, Ch, Ph) AG021
dilator *(n.)* FB059
diluent *(n.)* DD011
dilute[1] *(v.t.)* (Ch, Ph) DD027
dilute[2] *(adj.)* (Ch, Ph) DD032
dilution[1] *(n.)* (Ch) DD010
dilution[2] *(n.)* (Ch) EG006
dimer *(n.)* BH008
diminish[1] *(v.t.)* (Bio, Ch, Ph) AG034
diminish[2] *(v.i.)* (Bio; Ch, Ph) AG041
diminished *(adj.)* AG049
dimorphic *(adj.)* SD027
dimorphism *(n.)* SD017
Dines hygrometer *(n.)* EE075
dinoflagellate *(n.)* CB039
Dinophyceae *(n.pl.)* CB038
diode[1] *(n.)* (Ph) NL008
diode[2] *(n.)* (Ph) NM080
dioecious *(adj.)* SB036
dioecism *(n.)* SD086
dioptre *(n.)* ND062
dip circle *(n.)* QB050
diphyodont *(adj.)* ME109
diplo- *(pre.)* AL061
diploblastic *(adj.)* CJ023
diplococcus *(n.)* JC060
diploid *(adj.)* CU031
Diplopoda *(n.pl.)* CC056
diplotene *(n.)* CU065
Dipnoi *(n.pl.)* CC150
dipole[1] *(n.)* (Ph) QC042
dipole[2] *(n.)* (Ph) NM031
dipole aerial *(n.)* NM030
dipole moment *(n.)* QC043
Diptera *(n.pl.)* CC073
direct *(v.t.)* AF078
direct current *(n.)* NJ017
direct-current generator *(n.)* NK085
direction[1] *(n.)* (Bio, Ch, Ph) AF085
direction[2] *(n.)* (Bio, Ch, Ph) AQ020
direct vision spectroscope *(n.)* ND115
disaccharide[1] *(n.)* (Ch) BD102
disaccharide[2] *(n.)* (Bio, Ch) MD035
disc *(n.)* CG107
discharge[1] *(v.)* (Bio, Ph) AF107
discharge[2] *(v.)* (Ch) EG031
discharge in gases *(n.)* NE007
discharge lamp *(n.)* NE016
discharge tube *(n.)* NE015
discoid *(adj.)* CG136
discoidal[1] *(adj.)* (Bio) CG137
discoidal[2] *(adj.)* (Bio) SJ031
disconnect *(v.t.)* NJ081
discontinuous *(adj.)* AE021
discontinuous variation *(n.)* TA035
discourage *(v.t.)* FG029
discredit *(v.t.)* AM080
discrete *(adj.)* AB029
discriminator *(n.)* NM041
discuss *(v.)* AM026
disease *(n.)* JC002
disharmony *(n.)* FG008
disinfect *(v.t.)* JD010
disinfectant *(n.)* JD005
disinfestation *(n.)* JD003
disintegrate *(v.i.)* AB021
disintegration series *(n.)* NF021
dislocate *(v.t.)* AA034
disorder[1] *(n.)* (Bio, Ch, Ph) AC052
disorder[2] *(n.)* (Bio) JC005
disorder[3] *(n.)* (Bio, Ch, Ph) AM053
disparate *(adj.)* AP030
dispensable *(adj.)* AJ075
dispense with *(v.t.)* AJ064
dispersal *(n.)* GA042
disperse *(v.t.)* AG082
dispersed *(adj.)* DE015
disperse phase *(n.)* DE003
disperse systems *(n.)* DE001
dispersion *(n.)* ND086
dispersion medium *(n.)* DE002
dispersive medium *(n.)* ND110
dispersive power *(n.)* ND111
displace *(v.t.)* AF029
displacement[1] *(n.)* (Ph) EA011
displacement[2] *(n.)* (Ch) KA020
displacement current *(n.)* QC049
display *(v.t.)* AK025
disposable *(adj.)* AJ077
disposition *(n.)* AK013
disposition terms *(n.pl.)* AK017
disproportionation *(n.)* KA077
dissect *(v.t.)* AG072
disseminate *(v.)* AG090
dissimilar *(adj.)* AP029
dissipate *(v.t.)* AG084
dissociation *(n.)* KA030
dissonance *(n.)* NG100
distal *(adj.)* CG015
distance *(n.)* EA010
distend *(v.)* AG004
distil *(v.)* BB043
distillation *(n.)* BB018
distilling *(adj.)* BB068
distinct *(adj.)* AP028
distinction *(n.)* AM005
distinctive *(adj.)* AM037
distinguish *(v.)* AM019
distort *(v.t.)* AC021
distorted *(adj.)* AC033
distortion[1] *(n.)* (Bio, Ch, Ph) AC004
distortion[2] *(n.)* (Ph) NM019
distribute *(v.t.)* AG087
disturb *(v.t.)* AF027
disturbance *(n.)* AF045
diurnal[1] *(adj.)* (Bio) FD067
diurnal[2] *(adj.)* (Ph) QB053

diurnal rhythm *(n.)* FD059
diverge *(v.)* AF003
divergent *(adj.)* AF015
diverging *(adj.)* ND068
diversification *(n.)* CL010
divert *(v.t.)* AF009
diverticulum *(n.)* CG061
divide *(v.)* AG080
dividing nucleus *(n.)* CU002
division *(n.)* CA012
division of labour *(n.)* CU069
dizygotic *(adj.)* SJ038
DNA *(abbr.)* TB003
domestic *(adj.)* JD014
domesticated *(adj.)* GB019
dominance-recessiveness *(n.)* TC013
dominant[1] *(adj.)* (Bio) TC029
dominant[2] *(adj.)* (Bio) GA176
donate *(v.t.)* AG151
donor[1] *(n.)* (Ch) DA034
donor[2] *(n.)* (Bio) GB071
donor[3] *(n.)* (Bio) JB021
donor impurity *(n.)* NM059
doping *(n.)* NM050
Doppler effect *(n.)* NH032
d-orbital *(n.)* DB015
dormancy *(n.)* FA016
dormant[1] *(adj.)* (Bio) FA046
dormant[2] *(adj.)* (Bio) TA013
dormin *(n.)* JA080
dorsal *(adj.)* CG010
dorsal aorta *(n.)* PA017
dorsal fin *(n.)* CF103
dorsal fissure *(n.)* HB098
dorsal horn *(n.)* HB095
dorsal lip *(n.)* SH052
dorsigrade *(adj.)* FC025
dorsiventral *(adj.)* CG014
dorsoventral *(adj.)* CG013
double acting *(adj.)* NA065
double bond *(n.)* BD057
double-diode *(n.)* NL009
double fertilization *(n.)* SD061
double helix *(n.)* TB007
double refraction *(n.)* NB061
double salt *(n.)* BD019
down feather *(n.)* CF091
DPD *(abbr.)* FH008
drag[1] *(n.)* (Ph) EC078
drag[2] *(v.t.)* (Ph) EC063
drain[1] *(v.i.)* (Bio) FH075
drain[2] *(n.)* (Bio) JD021
drainage water *(n.)* FH062
D-region *(n.)* NC049
drift *(v.i.)* AF062
drip *(v.)* AF057
drive *(v.t.)* AF034
drop *(n.)* ED039
dropsy *(n.)* JC128
drown *(v.)* FH077
drug *(n.)* JC150
drupe *(n.)* CE165
drupel *(n.)* CE185
dry distillation *(n.)* BB020
dual nature of matter *(n.)* NC082
dubious *(adj.)* AM042
duct *(n.)* AC065
ductile[1] *(adj.)* (Ph, Ch) BA017
ductile[2] *(adj.)* (Ch) AB068
ductility *(n.)* BA006
ductless glands *(n.pl.)* JA001
ductus Cuvieri *(n.)* PA030
dull *(adj.)* BA020
dung *(n.)* GB047
duodenum *(n.)* MF031
dupli- *(pre.)* AL062
duplication *(n.)* TC041
durable *(adj.)* AH018
dura mater *(n.)* HB086
duration *(n.)* AH003
dwarfism *(n.)* JA036
dwindle *(v.i.)* AG044
dye *(n.)* BB127
dynamic *(adj.)* EB039
dynamic allotropy *(n.)* BE006
dynamic characteristics *(n.pl.)* NL024
dynamic equilibrium *(n.)* KB002
dynamic friction *(n.)* EC053
dynamic microphone *(n.)* NK042
dynamics *(n.sing)* EB016
dynamo *(n.)* NK084
dynamometer *(n.)* NJ099
dynode *(n.)* NL081
dys- *(pre.)* AL092

ear *(n.)* HD017
ear-drum *(n.)* HD024
ear ossicle *(n.)* HD032
earphone *(n.)* NK035
ear sand *(n.)* HD059
earth *(n.)* FH021
earthed *(adj.)* NK122
Earth inductor *(n.)* QB051
east-west asymmetry *(n.)* NC045
eatable *(adj.)* MH025
ecad *(n.)* CE006
eccrine *(adj.)* CM049
eccritic *(adj.)* FG043
ecdysis *(n.)* SG025
echelon echo *(n.)* NH023
echinate *(adj.)* CD007
Echinodermata *(n.pl.)* CC116
echo *(n.)* NH022
echo sounding *(n.)* NH024
eclipse *(n.)* ND006
ecological pyramid *(n.)* GA075
ecology *(n.)* GA001
ecospecies *(n.)* CA024
ecosystem *(n.)* GA026
ecotype *(n.)* CA025
ecto- *(pre.)* AL038
ectoderm *(n.)* CJ008
ectogenic *(adj.)* FD077
-ectomy *(suff.)* AL098
ectoparasite *(n.)* GA103
ectophloic *(adj.)* CH061
ectoplasm *(n.)* CT022
ectoplast *(n.)* CT033
Ectoprocta *(n.pl.)* CC050
edaphic factors *(n.pl.)* GA145
eddy *(n.)* EC072
eddy current *(n.)* NK057
Edentata *(n.pl.)* CC195
edentate *(adj.)* ME104
edge tone *(n.)* NH082
edible *(adj.)* MH024
EFA *(abbr.)* MD016
effect[1] *(n.)* (Bio, Ch, Ph) AJ053

effect[2] *(v.t.)* (Bio, Ch, Ph) AD008
effective *(adj.)* KD045
effector[1] *(n.)* (Bio) HB163
effector[2] *(n.)* (Bio) TC022
efferent nerve *(n.)* HB021
effervescence *(n.)* AD037
efficiency *(n.)* NA009
efficient *(adj.)* AQ016
effort *(n.)* NA005
effuse *(v.i.)* AF117
effusion *(n.)* ED008
egest *(v.t.)* MG027
egestion *(n.)* MG017
egg *(n.)* SH083
egg cell *(n.)* SB078
egg membranes *(n.pl.)* SH099
egg-white *(n.)* SH089
E.H.F. *(abbr.)* NC029
Einstein's photo-electric law *(n.)* NL079
ejaculate *(v.t.)* AF110
eject *(v.t.)* AF113
elaborate[1] *(v.t.)* (Ch, Ph) AD052
elaborate[2] *(v.t.)* (Bio) FG033
elaboration[1] *(n.)* (Bio) CL008
elaboration[2] *(n.)* (Bio) FG017
elaboratory *(adj.)* FG046
elaioplast *(n.)* CT081
elapse *(v.i.)* AH013
Elasmobranchii *(n.pl.)* CC144
elastic[1] *(adj.)* (Bio, Ch, Ph) AB066
elastic[2] *(adj.)* (Ch) BA031
elastic body *(n.)* AB012
elastic cartilage *(n.)* CN032
elastic collision *(n.)* EB023
elastic energy *(n.)* KE019
elastic fatigue *(n.)* KE022
elasticity *(n.)* KE001
elastic limit *(n.)* KE007
elastin *(n.)* CN015
elbow *(n.)* CJ069
electric *(adj.)* NJ026
electrical *(adj.)* NJ027
electrical appliance *(n.)* NK118
electrical energy *(n.)* NJ007
electric arc *(n.)* NE005
electric bell *(n.)* NK027
electric charge *(n.)* NJ002
electric current *(n.)* NJ003
electric displacement *(n.)* QC047
electric field *(n.)* QC005
electric hygrometer *(n.)* EE083
electric induction *(n.)* QC048
electric intensity *(n.)* QC009
electricity *(n.)* NJ001
electric light bulb *(n.)* NJ068
electric polarization *(n.)* QC045
electric power *(n.)* NJ008
electric space constant *(n.)* QC033
electric spark *(n.)* NE001
electric wind *(n.)* QC015
electrochemical *(adj.)* EG036
electrochemical equivalent *(n.)* EG041
electrochemical series *(n.)* EG053
electrode *(n.)* EG015
electrode potential *(n.)* EG049
electrolysis *(n.)* EG014
electrolyte *(n.)* EG020
electrolytic *(adj.)* EG035
electrolytic capacitor *(n.)* QC038
electrolyze *(v.t.)* EG030
electromagnet *(n.)* NK023
electromagnetic *(adj.)* NK022
electromagnetic induction *(n.)* NK050
electromagnetic radiation *(n.)* NC001
electromagnetic spectrum *(n.)* NC004
electromagnetic waves *(n.pl.)* NC002
electromagnetism *(n.)* NK001
electrometer *(n.)* NJ095
electromotive force (e.m.f.) *(n.)* EG044
electron *(n.)* DB005
electron affinity *(n.)* DA017
electron diffraction *(n.)* NE039
electronegativity *(n.)* DA016
electron gun *(n.)* NE036
electronics *(n.sing.)* NL001
electronic vacuum tube *(n.)* NL015
electron lens *(n.)* NE038
electron microscope *(n.)* NE040
electron pairing *(n.)* DA021
electron-volt *(n.)* QC012
electrophilic reagent *(n.)* KC002
electrophoresis *(n.)* DE034
electrophorus *(n.)* QC019
electroplating *(n.)* EG029
electroscope *(n.)* QC017
electrostatic *(adj.)* QC024
electrostatic force *(n.)* QC002
electrostatic generator *(n.)* QC018
electrostatic potential *(n.)* QC006
electrostatics *(n.sing)* QC001
electrostatic voltmeter *(n.)* NJ096
electrostriction *(n.)* QC016
electrovalency *(n.)* DC014
electrovalent bond *(n.)* DA003
element[1] *(n.)* (Bio, Ch, Ph) AB004
element[2] *(n.)* (Ph) NE045
element[3] *(n.)* (Ph) NJ054
element[4] *(n.)* (Ch) BC040
elementary *(adj.)* AM047
elephantiasis *(n.)* CC039
elevator[1] *(n.)* (Bio) FB054
elevator[2] *(n.)* (Ph) KD036
elevator[3] *(n.)* (Ph) KD038
eliminate *(v.t.)* AF121
elliptical polarization *(n.)* NB072
elongate *(v.)* AG006
elution *(n.)* EF019
emaciation *(n.)* JC133
emanate *(v.i.)* AF099
embolic *(adj.)* SH065
embolism *(n.)* CR082
embolus *(n.)* CR074
embryo[1] *(n.)* (Bio) SH002
embryo[2] *(n.)* (Bio) SH011
embryogenesis *(n.)* SH018
embryogeny *(n.)* SH019
embryology *(n.)* SH012
embryonal *(adj.)* SH022
embryonal knot *(n.)* SH043
embryonic *(adj.)* SH021
embryonic membranes *(n.pl.)* SH073
Embryophyta *(n.pl.)* CB005
embryo sac *(n.)* SD073
emeiocytosis *(n.)* CT004
emerge *(v.i.)* AF100
emergence *(n.)* CE028
emergent stem correction *(n.)* LA034
emigration *(n.)* GA084

eminence *(n.)* CG067
emission spectrum *(n.)* ND097
emit *(v.t.)* AF096
emitter *(n.)* NM096
emitter diode *(n.)* NM099
emotion *(n.)* HB179
emotional *(adj.)* HB198
emotive *(adj.)* HB199
empirical formula *(n.)* BE008
empirical generalization *(n.)* AM014
emulsifying agent *(n.)* DE005
emulsion *(n.)* DE004
emulsion polymerization *(n.)* BH006
emulsoid *(n.)* DE022
enamel *(n.)* ME070
enantiotropic *(adj.)* BE018
enantiotropy *(n.)* BE004
encephalon *(n.)* HB066
enclose *(v.t.)* CG265
enclosure *(n.)* CG258
encourage *(v.t.)* AD018
encyst[1] *(v.)* (Bio) CG297
encyst[2] *(v.)* (Bio) CA047
encystation *(n.)* CG276
encystment *(n.)* CG277
end *(v.)* AD027
endarch *(adj.)* CH063
end-bulb *(n.)* HE025
end correction *(n.)* NH087
endemic *(adj.)* JC053
endo- *(pre.)* AL039
endocarp *(n.)* CE137
endochondral *(adj.)* CN083
endocrine *(adj.)* CM045
endocrine gland *(n.)* JA002
endocrine system *(n.)* JA003
endocrinology *(n.)* JA015
endoderm *(n.)* CJ009
endodermis *(n.)* CS090
endogamy *(n.)* SA035
endogenous *(adj.)* FD071
endolymph *(n.)* HD056
endometrium *(n.)* SJ003
endomitosis *(n.)* CU008
endomysium *(n.)* CP039
endoneurium *(n.)* CQ027
endoparasite *(n.)* GA104
endopeptidase *(n.)* MA075
endoplasm *(n.)* CT021
endoplasmic reticulum *(n.)* CT066
Endoprocta *(n.pl.)* CC051
Endopterygota[1] *(n.pl.)* (Bio) CC071
Endopterygota[2] *(n.pl.)* (Bio) SG039
end-organ *(n.)* HB164
endoskeleton *(n.)* CK003
endosperm[1] *(n.)* (Bio) SD107
endosperm[2] *(n.)* (Bio) SD108
endospermous *(adj.)* SD114
endospore *(n.)* JC073
endosteum *(n.)* CN055
endostyle *(n.)* ME139
endothelium *(n.)* CM006
endothermic *(adj.)* LD011
endotoxin *(n.)* JB014
end-plate *(n.)* CP042
energize *(v.t.)* QA008
energy *(n.)* QA001
energy band diagram *(n.)* NM056
energy bands *(n.pl.)* NM051
energy barrier *(n.)* QA004
energy level *(n.)* DB007
engine *(n.)* NA026
engorge *(v.t.)* SE033
engulf[1] *(v.t.)* (Bio) CD018
engulf[2] *(v.t.)* (Bio) ME053
enhance *(v.t.)* AG138
enlarge *(v.t.)* AG002
enough *(adj.)* AN135
enquire *(v.t.)* AK008
enrich *(v.t.)* AG141
enter AL168
enteral *(adj.)* MF027
enteric *(adj.)* MF026
enteritis *(n.)* MF008
entero AL168
enterokinase *(n.)* MA061
enteron *(n.)* MF002
enthalpy *(n.)* LD008
entire[1] *(adj.)* (Bio, Ch, Ph) AN017
entire[2] *(adj.)* (Bio) CE091
entity *(n.)* AB009
entomology *(n.)* CC080
entomophily *(n.)* SD085
Entoprocta *(n.pl.)* CC052
entropy *(n.)* LD025
envelop *(v.t.)* CG266
envelope *(n.)* CG257
environment[1] *(n.)* (Bio, Ch, Ph) AA042
environment[2] *(n.)* (Bio) GA032
enzyme *(n.)* MA019
enzymolysis *(n.)* MA026
enzymolytic *(adj.)* MA031
ephemeral[1] *(n.)* (Bio) SD015
ephemeral[2] *(adj.)* (Bio) SD025
Ephemeroptera *(n.pl.)* CC091
epi- *(pre.)* AL007
epibolic *(adj.)* SH064
epicalyx *(n.)* SF069
epicarp *(n.)* CE135
epicondyle *(n.)* CG314
epicoracoid *(n.)* CK145
epicotyl *(n.)* CH085
epicuticle *(n.)* CF065
epidemic[1] *(n.)* (Bio) JC028
epidemic[2] *(adj.)* (Bio) JC054
epidermis[1] *(n.)* (Bio) CS078
epidermis[2] *(n.)* (Bio) CF025
epididymis *(n.)* SE022
epigamic character *(n.)* RA005
epigeal[1] *(adj.)* (Bio) FA062
epigeal[2] *(adj.)* (Bio) GA100
epigenous *(adj.)* GA122
epiglottis *(n.)* ME138
epigynous *(adj.)* SF031
epilepsy *(n.)* JC120
epimysium *(n.)* CP041
epineurium *(n.)* CQ028
epipetalous *(adj.)* SF167
epipharyngeal *(adj.)* ME134
epipharynx *(n.)* ME126
epiphyseal cartilage *(n.)* CN080
epiphysis[1] *(n.)* (Bio) HB125
epiphysis[2] *(n.)* (Bio) CN079
epiphyte *(n.)* GA111
epipubic bone *(n.)* CK174
episome *(n.)* TC066
episternum *(n.)* CK157
epithalamus *(n.)* HB126

epithelial *(adj.)* CM014
epithelial tissue *(n.)* CM001
epithelioid *(adj.)* CM015
epithelium *(n.)* CM002
epizoite *(n.)* GA112
epoch *(n.)* AH009
equation *(n.)* KA051
equation of state *(n.)* LD020
equations of motion *(n.pl.)* EA030
equatorial *(adj.)* CG056
equatorial plate *(n.)* CU046
equilibriant *(n.)* KD012
equilibrium[1] *(n.)*(Ch) KB001
equilibrium[2] *(n.)*(Ph) KD001
equilibrium constant *(n.)* KB005
equilibrium mixture *(n.)* KB006
equipotential *(adj.)* QC007
Equisetales *(n.pl.)* CB089
equivalent *(adj.)* DD037
equivalent conductivity *(n.)* EG005
equivalent weight *(n.)* DD015
era *(n.)* AH010
eradicate *(v.i.)* AF120
erect[1] *(adj.)*(Bio) CG088
erect[2] *(adj.)*(Bio) CH093
erectile *(adj.)* SE034
erector muscle *(n.)* CF042
erect stem *(n.)* CH067
E-region *(n.)* NC050
erepsin *(n.)* MA081
ergastic *(adj.)* CT049
ergastoplasm *(n.)* CT069
ergocalciferol *(n.)* MH049
ergosterol *(n.)* MD030
erosion *(n.)* FH072
erythr- *(pre.)* AL088
erythroblast *(n.)* CR017
erythrocruorin *(n.)* CR029
erythrocyte *(n.)* CR015
erythrophage *(n.)* CR018
escape *(n.)* GA142
-escence *(suff.)* AL131
essential *(adj.)* AE016
essential amino acids *(n.pl.)* MH003
essential elements *(n.pl.)* FH009
essential fatty acids *(n.pl.)* MD015
essential oil[1] *(n.)*(Bio) CS010
essential oil[2] *(n.)*(Bio) MD023
establish *(v.t.)* AA035
ester *(n.)* BD091
esterase *(n.)* MA084
estradiol *(n.)* JA063
estrogen *(n.)* JA062
estrogenic *(adj.)* JA069
estuarine *(adj.)* GA060
ethanol-in-glass thermometer *(n.)* LA022
ether *(n.)* BD083
ethnic *(adj.)* RA017
ethnology *(n.)* RA015
ethology *(n.)* GA095
etiolate *(v.i.)* CH092
etiolated *(adj.)* CH097
etiolation *(n.)* CH087
eubacteria *(n.pl.)* CA071
eucaryotic *(adj.)* CU038
euchromatin *(n.)* CT046
euglenoid movement *(n.)* FC003
Euglenophyta *(n.pl.)* CB035
eukaryotic *(adj.)* CU040
euphotic zone *(n.)* GA193
euryhaline *(adj.)* FH019
euryhygric *(adj.)* GA172
eurythermous *(adj.)* GA052
eustachian tube *(n.)* HD029
Eutheria *(n.pl.)* CC184
eutrophic *(adj.)* GA203
evacuate *(v.t.)* AA033
evacuation *(n.)* AA009
evaginate *(v.t.)* CG264
evaporate[1] *(v.t.)*(Bio, Ch, Ph) EE046
evaporate[2] *(v.i.)*(Bio, Ch, Ph) EE047
evaporation *(n.)* EE034
evapotranspiration *(n.)* FH069
event *(n.)* AH005
eventual *(adj.)* AH021
evergreen *(adj.)* CE036
evidence *(n.)* AM007
evident *(adj.)* AM044
eviscerate *(v.t.)* CJ042
evocation *(n.)* SH062
evocator *(n.)* SH061
evolution[1] *(n.)*(Ch) AD036
evolution[2] *(n.)*(Bio) RA001
evolve[1] *(v.t.)*(Ch) AD044
evolve[2] *(v.t.)*(Bio, Ch, Ph) AD051
evolve[3] *(v.)*(Bio, Ch, Ph) AG017
evolve[4] *(v.i.)*(Bio) AG018
exact *(adj.)* AN022
exarch *(adj.)* CH064
exceed *(v.t.)* AN052
exceedingly *(adv.)* AN128
except *(v.t.)* AF123
excess[1] *(n.)*(Bio, Ch, Ph) AN045
excess[2] *(n.)*(Ch) BA019
excess[3] *(adj.)*(Ch) BB060
excessive *(adj.)* AN127
exchange *(v.t.)* AF031
excise *(v.t.)* AG077
excitability *(n.)* FG019
excitable *(adj.)* FG048
excitation *(n.)* FG014
excitatory *(adj.)* FG047
exclude *(v.t.)* AF122
exclusive *(adj.)* AE023
exconjugant *(n.)* SB120
excreta *(n.pl.)* FE006
excrete *(v.t.)* FE016
excretion *(n.)* FE005
excretive *(adj.)* FE019
excretory *(adj)* FE018
exemplify *(v.t.)* AM078
exendospermous *(adj.)* SD116
exhalant *(adj.)* MJ030
exhalation *(n.)* MJ008
exhale *(v.)* MJ023
exhaust[1] *(v.t.)*(Bio, Ch, Ph) AA032
exhaust[2] *(v.t.)*(Bio, Ch, Ph) AJ086
exhaust[3] *(v.t.)*(Ph) NA060
exhaust[4] *(n.)*(Ph) NA035
exhibit *(v.t.)* AK024
exist *(v.i.)* AD005
existence *(n.)* AD002
exo- *(pre.)* AL040
exocarp *(n.)* CE138
exocrine *(adj.)* CM044
exodermis *(n.)* CH117
exogenous *(adj.)* FD076

exopeptidase *(n.)* MA074
exophthalmia *(n.)* HC055
exophthalmic goitre *(n.)* JA040
Exopterygota[1] *(n.pl.)* (Bio) SG044
Exopterygota[2] *(n.pl.)* (Bio) CC081
exoskeleton *(n.)* CK002
exothermic *(adj.)* LD010
exotoxin *(n.)* JB015
expand *(v.)* AG020
expansion *(n.)* AG025
expansion of gases *(n.)* LA061
expansion of liquids *(n.)* LA052
expansion of solids *(n.)* LA046
expansion of water *(n.)* LA060
expectorant *(n.)* MJ103
expectorate *(v.i.)* MJ105
expel *(v.t.)* AF112
expend *(v.t.)* AJ083
experience *(n.)* HB174
experiment *(n.)* AQ001
experimental *(adj.)* AQ017
expiration *(n.)* MJ007
expire *(v.t.)* MJ026
explain *(v.t.)* AM024
explanatory *(adj.)* AM045
explode *(v.)* LC002
exploit *(v.t.)* AJ087
exploratory *(adj.)* AK009
explore *(v.t.)* AK006
explosive *(adj.)* LC004
exponential decay *(n.)* NF020
expose *(v.t.)* JC032
exposure *(n.)* JC027
exposure meter *(n.)* NL082
express *(v.t.)* AF116
expressivity *(n.)* TC081
extend[1] *(v.t.)* (Bio, Ch, Ph) AG009
extend[2] *(v.)* (Bio) FB010
extend[3] *(v.)* (Bio) AD007
extended *(adj.)* AG026
extendible *(adj.)* AG028
extensible *(adj.)* AG027
extensile *(adj.)* AG029
extensive *(adj.)* AA036
extensive property *(n.)* AB058
extensor *(n.)* FB051
extent *(n.)* AA012
external *(adj.)* CG024
external auditory meatus *(n.)* HD019
external digestion *(n.)* MG005
external features *(n.pl.)* CD005
external fertilization *(n.)* SB028
external gills *(n.pl.)* MJ041
external respiration *(n.)* MJ002
exteroceptor *(n.)* HB160
extinct *(adj.)* RA016
extinction *(n.)* RA010
extinction potential *(n.)* NE021
extinguish *(v.t.)* AD062
extracellular *(adj.)* CT013
extracellular digestion *(n.)* MG003
extract[1] *(v.t.)* (Bio, Ch, Ph) AF119
extract[2] *(n.)* (Bio) JC153
extraction[1] *(n.)* (Ch) BB090
extraction[2] *(n.)* (Ch) BB122
extraction[3] *(n.)* (Ch) KA047
extraembryonic *(adj.)* SH023
extraembryonic membranes *(n.pl.)* SH074
extraordinary ray *(n.)* NB063
extrapolate *(v.t.)* AN117
extremely high frequency *(n.)* NC028
extrinsic *(adj.)* FB064
extrinsic semiconductor *(n.)* NM049
extrude *(v.t.)* AF114
exuberant *(adj.)* AN122
exude *(v.)* AF102
eye *(n.)* HC011
eyeball *(n.)* HC037
eye defect *(n.)* HC078
eyelash *(n.)* HC057
eyelid *(n.)* HC056
eye muscles *(n.pl.)* HC060
eye-piece *(n.)* ND078
eye-spot *(n.)* HC012

F+ *(abbr.)* TC064
F− *(abbr.)* TC065
F_1 *(abbr.)* TA023
F_2 *(abbr.)* TA024
face-centred cube *(n.)* DA026
facet *(n.)* CG320
facial nerve *(n.)* HB039
factor *(n.)* AJ049
facultative *(adj.)* MJ034
facultative parasite *(n.)* GA106
fade *(v.)* AG045
fading *(n.)* NC026
faeces *(n.pl.)* MG015
Fagales *(n.pl.)* CB115
Fahrenheit scale *(n.)* LA006
fall *(v.i.)* FC036
fallopian tube *(n.)* SE044
fallow *(adj.)* GB017
false fruit *(n.)* CE194
false palate *(n.)* ME028
false rib *(n.)* CK049
family *(n.)* CA007
fang *(n.)* ME068
farad *(n.)* KG033
faraday *(n.)* EG040
Faraday dark space *(n.)* NE011
Faraday's law *(n.)* NK052
farming *(n.)* GB020
fascia *(n.)* CG165
fasciation *(n.)* CH089
fascicle *(n.)* CG166
fascicular[1] *(adj.)* (Bio) CP046
fascicular[2] *(adj.)* (Bio) CH018
fasciculate *(adj.)* CP047
fasciculi *(n.pl.)* CP038
fasciculus *(n.)* HB104
fast *(adj.)* AH026
fat[1] *(n.)* (Ch) BD092
fat[2] *(n.)* (Bio) MD007
fat[3] *(adj.)* (Bio) CG100
fat-body *(n.)* FF013
fat cell *(n.)* CN008
fatty *(adj.)* MD026
fatty acid *(n.)* MD008
fault *(n.)* AC049
fauna *(n.pl.)* GA079
favour *(v.t.)* AD019
favourable *(adj.)* FG042
f-block elements *(n.pl.)* BD049
feather *(n.)* CF079
feathered *(adj.)* CF098
feathery *(adj.)* CF099
feature[1] *(n.)* (Bio, Ch, Ph) AC007

feature[2] *(n.)* (Bio, Ch, Ph) AB060
feedback *(n.)* AJ051
feed-back *(n.)* NL054
Fehling's test *(n.)* MD049
femur[1] *(n.)* (Bio) CK107
femur[2] *(n.)* (Bio) CK202
fen *(n.)* GA151
fenestra ovalis *(n.)* HD073
fenestra rotunda *(n.)* HD074
fenestra vestibuli *(n.)* HD075
ferment *(n.)* MA020
fermentation *(n.)* MA010
ferromagnetic *(adj.)* NK021
fertile[1] *(adj.)* (Bio) SB067
fertile[2] *(adj.)* (Bio) FH044
fertility[1] *(n.)* (Bio) SB056
fertility[2] *(n.)* (Bio) FH043
fertilization *(n.)* SB027
fertilization membrane *(n.)* SB030
fertilizer *(n.)* GB044
fever *(n.)* JC109
fibres[1] *(n.pl.)* (Bio) CS073
fibres[2] *(n.pl.)* (Bio) CN012
fibrin *(n.)* CR067
fibrinogen *(n.)* CR066
fibroblast *(n.)* CN010
fibro-cartilage *(n.)* CN034
fibrous attachment *(n.)* FB032
fibrous root *(n.)* CH107
fibula *(n.)* CK109
fibulare *(n.)* CK117
field *(n.)* QA005
field capacity *(n.)* FH063
field coil *(n.)* NK091
fifth *(n.)* NH111
filament[1] *(n.)* (Bio) CG155
filament[2] *(n.)* (Ph) NJ067
filament[3] *(n.)* (Bio) SF156
filamentous *(adj.)* CG158
filaria *(n.)* CC032
filariasis *(n.)* CC038
Filicales *(n.pl.)* CB091
film *(n.)* ED040
film pressure *(n.)* ED044
filoplume *(n.)* CF092
filter[1] *(n.)* (Ph) NC005
filter[2] *(n.)* (Ph) NL046
filter[3] *(v.t.)* (Bio, Ch, Ph) BB046
filtrate *(n.)* BB011
filtration *(n.)* BB010
fimbria *(n.)* CD014
fin *(n.)* CF101
final *(adj.)* AC029
final velocity *(n.)* EA025
find *(v.t.)* AD013
fine[1] *(adj.)* (Bio, Ch, Ph) AB035
fine[2] *(adj.)* (Bio, Ch, Ph) AN026
fine chemical *(n.)* BB083
finely divided *(adj.)* BC013
finish *(v.t.)* AD028
fire algae *(n.pl.)* CB037
first meiotic division *(n.)* CU061
fissure *(n.)* AA084
fixation *(n.)* KA048
fixation muscle *(n.)* FB045
fixed *(adj.)* AN085
fixed oil *(n.)* MD022
fixed points *(n.pl.)* LA011
flabby *(adj.)* CP029
flaccid *(adj.)* CT095
flagella[1] *(n.pl.)* (Bio) FC005
flagella[2] *(n.pl.)* (Bio) CD013
Flagellata *(n.pl.)* CA058
flagellate[1] *(n.)* (Bio) CA060
flagellate[2] *(adj.)* (Bio) CD022
flagellum *(n.)* CD011
flame cell *(n.)* FF003
flammable *(adj.)* AD067
flap[1] *(n.)* (Bio) CG191
flap[2] *(v.)* (Bio) FC050
flare *(v.i.)* CG080
flask-shaped gland *(n.)* CM033
flat (♭) *(adj.)* NH118
flatworm *(n.)* CC025
flaw *(n.)* AC050
flee *(v.i.)* FC017
Fleming's left-hand rule *(n.)* NK017
Fleming's right-hand rule *(n.)* NK055
fleshy attachment *(n.)* FB033
flex[1] *(v.)* (Bio) FB009
flex[2] *(n.)* (Ch, Ph) NJ049
flexible *(adj.)* CG329
flexible cord *(n.)* NJ048
flexor *(n.)* FB050
flick *(v.)* FB013
flicker *(v.i.)* AG058
flight *(n.)* FC014
flipper *(n.)* FC030
floating rib *(n.)* CK050
flocculation *(n.)* FH039
flocculent *(adj.)* DD048
flock *(n.)* GA082
flora *(n.)* GA125
floral *(adj.)* SF020
floral diagram *(n.)* SF108
floral formula *(n.)* SF106
floral leaf *(n.)* SF047
floret *(n.)* SF006
florigens *(n.pl.)* JA085
floss *(n.)* SG024
flow *(v.i.)* AF056
flower *(n.)* SF001
flowering *(adj.)* SF019
flower stalk *(n.)* SF009
fluctuate *(v.i.)* AF083
fluctuating *(adj.)* AN104
fluctuation *(n.)* AN048
flue organ pipe *(n.)* NH085
fluid[1] *(n.)* (Bio, Ch, Ph) AB006
fluid[2] *(n.)* (Ch) BC033
fluke[1] *(n.)* (Bio) CF109
fluke[2] *(n.)* (Bio) CC027
fluorescence *(n.)* ND014
flush *(v.t.)* AF118
flutter[1] *(v.)* (Bio, Ch, Ph) AG057
flutter[2] *(n.)* (Ph) NM020
flux[1] *(n.)* (Ph) QA006
flux[2] *(n.)* (Ph) QC010
flux density[1] *(n.)* (Ph) NK005
flux density[2] *(n.)* (Ph) QC011
flux linkage *(n.)* NK008
fluxmeter *(n.)* NK009
fly *(v.i.)* FC035
FM *(abbr.)* NM015
FM cyclotron *(n.)* NE051
foam *(n.)* DE010
focal depth *(n.)* ND059
focal length[1] *(n.)* (Ph) ND030

focal length[2] *(n.)* (Ph) ND058
focal plane *(n.)* ND057
focus[1] *(n.)* (Bio, Ch, Ph) AK036
focus[2] *(n.)* (Ph) ND055
focus[3] *(v.t.)* (Ph) ND066
fodder *(n.)* GB023
foetal *(adj.)* SJ035
foetal membranes *(n.pl.)* SJ014
foetus *(n.)* SJ013
fog *(n.)* EE063
foil *(n.)* AB044
foliage *(n.)* CE014
foliage leaf *(n.)* CE048
foliar *(adj.)* CE058
foliate *(adj.)* CE059
foliation *(n.)* CE008
folic acid *(n.)* MH066
folicolous *(adj.)* MH032
foliose *(adj.)* CB076
follicle[1] *(n.)* (Bio) CE156
follicle[2] *(n.)* (Bio) CG280
follicle cell *(n.)* SB083
follicle-stimulating hormone *(n.)* JA053
following *(adj.)* AH035
food chain *(n.)* GA067
food web *(n.)* GA068
foramen *(n.)* CG315
foramen of Munro *(n.)* HB151
Foraminifera *(n.pl.)* CA056
forbidden band *(n.)* NM055
forbidden zone *(n.)* NM054
force *(n.)* EB001
forced oscillation *(n.)* NB094
forced vibration[1] *(n.)* (Ph) NB093
forced vibration[2] *(n.)* (Ph) NH015
fore *(adj.)* CJ083
forearm *(n.)* CJ068
fore-brain *(n.)* HB116
forget *(v.)* HB189
form[1] *(n.)* (Bio) AC001
form[2] *(n.)* (Ch) AC002
form[3] *(n.)* (Ch, Ph) AB040
form[4] *(v.t.)* (Bio, Ch, Ph) AJ021
form[5] *(v.)* (Bio, Ch, Ph) AD031
formation[1] *(n.)* (Bio, Ch, Ph) AD021
formation[2] *(n.)* (Bio) GA128
former *(n.)* NK046
formula[1] *(n.)* (Ch) BE007
formula[2] (for a stretched string) *(n.)* (Ph) NH069
formula weight *(n.)* ED025
fornix *(n.)* HB145
Fortin barometer *(n.)* KF030
forward bias *(n.)* NM074
fossa *(n.)* CG316
fossil *(n.)* RA009
fovea *(n.)* HC090
fovea centralis *(n.)* HC089
fraction *(n.)* BB025
fractional crystallization *(n.)* BB015
fractional distillation *(n.)* BB019
fractionate *(v.t.)* BB044
fractionating column *(n.)* BB024
fracture *(v.)* AG097
fragment *(n.)* AB015
fragrant *(adj.)* HE008
frame aerial *(n.)* NM028
frame antenna *(n.)* NM029
Fraunhofer diffraction *(n.)* NB044
free *(adj.)* AB028
free-central placentation *(n.)* SF152
free drifting *(adj.)* GA206
free electron *(n.)* NM057
free energy *(n.)* LD024
free living *(adj.)* GA050
free radical *(n.)* BC051
free swimming *(adj.)* GA205
free vibration *(n.)* NH014
freeze *(v.)* EE053
freezing mixture *(n.)* EE039
freezing point *(n.)* EE041
F-region *(n.)* NC051
frequency[1] *(n.)* (Ph) NB020
frequency[2] *(n.)* (Ph) NH044
frequency modulation *(n.)* NM012
frequent *(v.t.)* GA044
freshwater *(n.)* GA195
Fresnel diffraction *(n.)* NB045
friable *(adj.)* AB054
friction *(n.)* EC048
frictional *(adj.)* EC066
fringe[1] *(n.)* (Bio) CG063
fringe[2] *(n.)* (Ph) NB034
frond[1] *(n.)* (Bio) CE055
frond[2] *(n.)* (Bio) CH038
frosted *(adj.)* AC043
froth *(n.)* DE011
froth flotation *(n.)* BB093
fructiferous *(adj.)* CE146
fructification *(n.)* CE133
fructose *(n.)* MD042
frugivorous *(adj.)* MH031
fruit *(n.)* CE131
fruit body *(n.)* SF182
fruiting body *(n.)* SF183
fruticose *(adj.)* CB077
fry *(n.)* SG060
FSH *(abbr.)* JA060
fucivorous *(adj.)* MH037
fucoid[1] *(n.)* (Bio) CB031
fucoid[2] *(adj.)* (Bio) CB040
fulcrum *(n.)* NA011
fullness *(n.)* MH015
full-wave rectification *(n.)* NK112
fully *(adv.)* AQ038
fumigation[1] *(n.)* (Ch) BB112
fumigation[2] *(n.)* (Bio) JD004
function[1] *(n.)* (Bio, Ch, Ph) AJ043
function[2] *(n.)* (Bio) FG001
functional *(adj.)* FG035
functional group *(n.)* BD062
fundamental[1] *(adj.)* (Bio, Ch, Ph) AM030
fundamental[2] *(n.)* (Bio, Ch, Ph) NH046
fundamental interval *(n.)* LA016
fundamental quantities *(n.pl.)* AN032
fundus *(n.)* CM036
fungal *(adj.)* CB060
Fungi *(n.pl.)* CB041
fungicolous *(adj.)* GA121
fungiform *(adj.)* CB062
Fungi Imperfecti *(n.pl.)* CB058
fungine *(n.)* CN021
fungivorous *(adj.)* MH036
fungoid *(adj.)* CB061
fungus *(n.)* CB041
funicle *(n.)* SD065
funiculi *(n.pl.)* SD072
funiculus[1] *(n.)* (Bio) SD066

funiculus[2] *(n.)* (Bio) CQ025
fur *(n.)* CF047
furrow *(n.)* GB038
fuse[1] *(v.)* (Ch) BA010
fuse[2] *(n.)* (Ph) NJ066
fused[1] *(adj.)* (Ch) BC012
fused[2] *(adj.)* (Bio) CG326
fusibility *(n.)* BA003
fusible *(adj.)* BA014
fusiform *(adj.)* CG123
fusion *(n.)* LB037
fusion nucleus *(n.)* SD076

G EB054
gain *(n.)* NM032
gait *(n.)* FC032
galactose *(n.)* MD043
gall *(n.)* MA106
gall-bladder *(n.)* MA113
gallop *(v.i.)* FC037
gallstone *(n.)* MA118
Galton's whistle *(n.)* NH071
galvanize *(v.t.)* BB117
galvanometer *(n.)* NJ089
galvanotaxis *(n.)* FD011
galvanotropism *(n.)* FD034
gam AL144
gametangium *(n.)* SB121
gamete *(n.)* SB002
gametid *(n.)* SB006
gametocyst *(n.)* SB135
gametocyte *(n.)* SB005
gametogenesis *(n.)* SB022
gametophore *(n.)* SD004
gametophyll *(n.)* SF192
gametophyte *(n.)* SD003
gametothallus *(n.)* SB134
γ-radiation *(n.)* NF007
gamodeme *(n.)* CA027
gamogenesis *(n.)* SA022
gamont *(n.)* SD039
gamopetalous *(adj.)* SF062
gamosepalous *(adj.)* SF066
ganglia *(n.pl.)* HB054
ganglion *(n.)* HB049
ganglionated *(adj.)* HB057
ganglioneural nervous system *(n.)* HB004
ganglionic *(adj.)* HB058
ganoid scale *(n.)* CF009
ganoine *(n.)* ME085
gape[1] *(v.i.)* (Bio) ME012
gape[2] *(n.)* (Bio) ME011
gas[1] *(n.)* (Bio, Ch, Ph) AB008
gas[2] *(n.)* (Ch) BC031
gas chromatography *(n.)* EF015
gaseous *(adj.)* BC038
gaseous film *(n.)* ED041
gas equation *(n.)* EE015
gas laws *(n.pl.)* EE006
gas thermometer *(n.)* LA028
gastr AL169
gastral *(adj.)* MG033
gastric *(adj.)* MF028
gastric juice *(n.)* MG020
gastrin *(n.)* JA049
gastritis *(n.)* MF009
gastro AL169
gastrointestinal hormones *(n.pl.)* JA047
Gastropoda *(n.pl.)* CC103
gastrula *(n.)* SH045
gastrulation *(n.)* SH046
gauze *(n.)* AC019
Gay-Lussac's law *(n.)* ED003
gear *(n.)* NA048
gear wheel *(n.)* NA049
geiger counter *(n.)* NF028
gel *(n.)* DE024
gelation *(n.)* DE028
gemma *(n.)* SC054
gemmaceous *(adj.)* SC059
gemma-cup *(n.)* SC055
gemmate *(adj.)* SC060
gemmation *(n.)* SC005
gemmiferous *(adj.)* SC061
gemmiform *(adj.)* SC063
gemmiparous *(adj.)* SC062
gemmulation *(n.)* SC006
gemmule *(n.)* SC056
gen AL142
gene *(n.)* TC001
genecology *(n.)* GA007
gene exchange *(n.)* TC076
gene flow *(n.)* TC077
gene frequency *(n.)* TC074
gene pool *(n.)* TC078
general *(adj.)* AM033
general formula *(n.)* BD060
generalization *(n.)* AM013
general theory of relativity *(n.)* EC037
generate *(v.t.)* BB040
generating vessel *(n.)* BB008
generation[1] *(n.)* (Ch) BB003
generation[2] *(n.)* (Bio) TA003
generator[1] *(n.)* (Ph) NK083
generator[2] *(n.)* (Ch) BB002
-genesis *(suff.)* AL133
genetic *(adj.)* TC026
genetic code *(n.)* TB016
genetic drift *(n.)* TC075
genetics *(n. sing.)* TC024
genitalia *(n.pl.)* SE015
genital organs *(n.pl.)* SE001
genitals *(n.pl.)* SE016
genom *(n.)* TC060
genome *(n.)* TC059
genotype *(n.)* TC010
genus *(n.)* CA006
geo- *(pre.)* AL110
geographical meridian *(n.)* QB033
geology *(n.)* RA012
geometry *(n.)* NK048
geotaxis *(n.)* FD004
geotropism *(n.)* FD027
geriatric *(adj.)* FA044
geriatrics *(n.)* FA032
germ *(n.)* JC021
germ cells *(n.)* SB003
germicidal *(adj.)* JC079
germinal *(adj.)* SH024
germinal disc *(n.)* SH032
germination *(n.)* FA059
germ layer *(n.)* SH047
gerontic *(adj.)* FA043
gerontology *(n.)* FA031
gestation *(n.)* SJ017
gestation period *(n.)* SJ018
giant molecular crystal *(n.)* BG012

giant nerve fibre *(n.)* HB030
giant structure *(n.)* BG011
gibberellins *(n.pl.)* JA077
gigantism *(n.)* JA012
gill *(n.)* MJ039
gill arch *(n.)* MJ047
gill bar *(n.)* MJ043
gill book *(n.)* MJ057
gill cleft *(n.)* MJ046
gill filament *(n.)* MJ050
gill lamella *(n.)* MJ053
gill pouch *(n.)* MJ045
gill raker *(n.)* MJ048
gills *(n.pl.)* SF188
gill slit *(n.)* MJ042
gingiva *(n.)* ME024
gingivitis *(n.)* ME043
girder *(n.)* KD028
girdle[1] *(n.)* (Bio) CG118
girdle[2] *(n.)* (Bio) CK133
girth *(n.)* CG112
given *(adj.)* AN062
give off *(v.t.)* AF103
give out *(v.t.)* AF104
give rise to *(v.t.)* AD050
gizzard *(n.)* MF013
glabrous *(adj.)* CE067
Glaisher factor *(n.)* EE080
glance *(v.i.)* NB052
gland *(n.)* CM031
gland cell *(n.)* CM020
glandular *(adj.)* CM042
glandular cells *(n.pl.)* CM019
glandular epithelium *(n.)* CM018
glass *(n.)* BH001
Gleeson's capsule *(n.)* MA090
glenoid cavity *(n.)* CK149
glia *(n.)* CQ004
glide *(v.i.)* FC051
globe *(n.)* CG119
globular *(adj.)* CG132
globule *(n.)* CG120
globulin *(n.)* MD004
globulins *(n.pl.)* JB042
glomeration *(n.)* CG121
glomerular *(adj.)* CG133
glomerulate *(adj.)* SF113
glomerule *(n.)* SF102
glomerulus *(n.)* FF041
glossa *(n.)* ME123
glossopharyngeal nerve *(n.)* HB041
glottis *(n.)* ME137
glow[1] *(v.i.)* (Bio, Ch, Ph) AD061
glow[2] *(v.i.)* (Ch, Ph) NE028
glow discharge *(n.)* NE009
glucagon *(n.)* MA129
glucocorticoids *(n.pl.)* JA020
glucose *(n.)* MD041
glume *(n.)* SF077
Glumiflorae *(n.pl.)* CB100
glutition *(n.)* ME142
glyceride *(n.)* MD013
glycerin *(n.)* MD014
glycerol *(n.)* MD012
glycogen *(n.)* MA097
glycogenesis *(n.)* MA098
glycogenolysis *(n.)* MA099
glycolysis *(n.)* MA009
glycoprotein *(n.)* CM026
gnath AL177
Gnathostomata *(n.pl.)* CC133
gnaw *(v.)* ME095
goblet cell *(n.)* CM021
goitre *(n.)* JC192
Golgi apparatus *(n.)* CT068
gon AL143
gonad *(n.)* SB040
gonadotropic *(adj.)* JA066
gonadotropin *(n.)* JA050
gong[1] *(n.)* (Ph) NH093
gong[2] *(n.)* (Ph) NK030
gonidium *(n.)* SB011
gonoduct *(n.)* SE006
Gossage process *(n.)* BB109
governor *(n.)* AJ052
Graafian follicle *(n.)* SB095
gradation *(n.)* BA007
graduated *(adj.)* BB064
graduation *(n.)* BB035
graft[1] *(n.)* (Bio) GB065
graft[2] *(v.t.)* (Bio) GB077
graft hybrid *(n.)* GB076
grafting *(n.)* GB064
Graham's law *(n.)* ED004
grain *(n.)* AB017
-gram *(suff.)* AL135
Graminales *(n.pl.)* CB104
gramme molecular volume *(n.)* DD017
gramme molecule *(n.)* DD014
grana *(n.pl.)* CT073
grand period of growth *(n.)* FA003
granular *(adj.)* AB036
granulated *(adj.)* AB037
granule *(n.)* AB018
-graph *(suff.)* AL135
gravel *(n.)* FH032
gravimetric *(adj.)* BB063
gravimetric analysis *(n.)* BB031
gravitate *(v.i.)* EB068
gravitation *(n.)* EB042
gravitational *(adj.)* EB072
gravitational constant *(n.)* EB044
gravitational field *(n.)* EB045
gravitational mass *(n.)* EB050
gravitational water *(n.)* FH065
gravity *(n.)* EB046
graze *(v.i.)* GB032
green algae *(n.pl.)* CB024
green gland *(n.)* FF005
greenhouse *(n.)* LB024
greenhouse effect *(n.)* LB025
green manure *(n.)* GB045
grey matter *(n.)* HB075
grid[1] *(n.)* (Ph) NK103
grid[2] *(n.)* (Ph) NL016
grid bias *(n.)* NL020
grid leak *(n.)* NL021
grind *(v.)* ME100
grip *(v.)* CG206
groove *(n.)* AC069
gross productivity *(n.)* GA016
ground *(n.)* FH036
grounded base circuit *(n.)* NM118
ground tissue[1] *(n.)* (Bio) CH030
ground tissue[2] *(n.)* (Bio) CS064
ground wave *(n.)* NC012
group[1] *(n.)* (Ch) BD045
group[2] *(n.)* (Bio) CA003
group[3] *(v.)* (Bio) CA029
group displacement law *(n.)* NF026

group velocity *(n.)* NB023
grow[1] *(v.i.)* (Bio, Ch, Ph) AD041
grow[2] *(v.)* (Bio) AD049
growth *(n.)* FA001
growth hormone *(n.)* JA022
guard cell *(n.)* CE071
gubernaculum *(n.)* SE028
guided missile *(n.)* EC004
gullet *(n.)* MF007
gulley *(n.)* CG200
gully erosion *(n.)* FH074
gulp *(v.t.)* ME144
gum[1] *(n.)* (Bio) CS011
gum[2] *(n.)* (Bio) ME023
gush *(v.i.)* AF111
gustatory *(adj.)* ME056
gut *(n.)* MF001
guttation *(n.)* FH007
Gymnospermae *(n.pl.)* CB092
gyn AL146
gynaecium *(n.)* SF126
gynandromorph *(n.)* SB049
gynodioecious *(adj.)* SD094
gynoecium *(n.)* SF117
gynomonoecious *(adj.)* SD096

Haber process *(n.)* BB102
habit *(n.)* HB177
habitat *(n.)* GA027
habituation *(n.)* HB159
haem[1] (Bio) AL156
haem[2] *(n.)* (Bio) CR031
haemal *(adj.)* CR034
haemal arch *(n.)* CK043
haemal spine *(n.)* CK045
haemapophysis *(n.)* CK044
haematin *(n.)* CR032
haematoblast *(n.)* CR003
haematocyte *(n.)* CR004
haemocoel *(n.)* PA003
haemocyanin *(n.)* CR026
haemocyte *(n.)* CR061
haemoglobin *(n.)* CR025
haemolymph *(n.)* CJ040
haemolysin *(n.)* CR021
haemolysis *(n.)* CR020
haemolytic *(adj.)* CR033
haemophilia *(n.)* CR078
haemophiliac *(n.)* CR079
haemopoiesis *(n.)* CR019
haemorrhage *(n.)* CR077
hair *(n.)* CF038
hair bulb *(n.)* CF040
hair follicle *(n.)* CF039
hair hygrometer *(n.)* EE082
half-flower *(n.)* SF107
half-life *(n.)* NF016
half-moon shaped *(adj.)* CG149
half-wave plate *(n.)* NB070
half-wave rectification *(n.)* NK111
halide *(n.)* BD021
halitosis *(n.)* MJ104
Hall coefficient *(n.)* NM066
Hall effect *(n.)* NM065
hallucination *(n.)* JC163
hallux *(n.)* CK076
halo- *(pre.)* AL112
haloform *(n.)* BD085
halogen *(n.)* BD020
halogenation *(n.)* KA014
halophyte *(n.)* GA137
halteres *(n.pl.)* CF071
hammer *(n.)* HD036
haplo- *(pre.)* AL060
haplochlamydeous *(adj.)* SF049
haploid *(adj.)* CU032
haploid number *(n.)* CU026
haplostele *(n.)* CH050
happen *(v.i.)* AD011
haptotropism *(n.)* FD037
hard *(adj.)* QB027
hard palate *(n.)* ME029
hard water *(n.)* DD023
Hardy-Schultze rule *(n.)* DE037
harm *(v.t.)* AG115
harmful *(adj.)* AG125
harmless *(adj.)* AG132
harmonic *(n.)* NH049
harmony[1] *(n.)* (Bio) FG007
harmony[2] *(n.)* (Ph) NH102
harrow *(n.)* GB037
harrowing *(n.)* GB040
harsh *(adj.)* FG045
hastate *(adj.)* CE103
hatch *(v.)* SH102
haustorium *(n.)* CH013
Haversian canal *(n.)* CN064
Haversian spaces *(n.pl.)* CN069
Haversian system *(n.)* CN068
hay *(n.)* GB024
head *(n.)* FB036
headache *(n.)* JC110
head on *(adv.)* AG111
heal *(v.i.)* JC100
health *(n.)* JC012
healthy *(adj.)* JC044
hearing *(n.)* HD001
heart *(n.)* PA042
heart beat *(n.)* PA058
heart block *(n.)* PA067
heart-shaped *(adj.)* CG148
heartwood *(n.)* CH080
heat *(v.t.)* AD055
heat capacity *(n.)* LB029
heath *(n.)* GA152
heat of combustion *(n.)* LD003
heat of formation *(n.)* LD004
heat of neutralization *(n.)* LD006
heat of reaction *(n.)* LD002
heat of solution *(n.)* LD005
heat sink *(n.)* NM123
Heaviside-Kennelly layer *(n.)* NC052
heavy *(adj.)* DD049
heavy chemical *(n.)* BB082
heel *(n.)* CJ077
heli- *(pre.)* AL108
heliotropism *(n.)* FD035
helium vapour pressure thermometer *(n.)* LA031
helix *(n.)* CG104
hemi- *(pre.)* AL050
hemibranch *(n.)* MJ051
hemicellulose *(n.)* CS016
Hemichordata *(n.pl.)* CC123
hemichordate *(adj.)* CC140
Hemimetabola *(n.pl.)* SG040
hemimetabolism *(n.)* SG046
Hemiptera *(n.pl.)* CC090

hemizygous *(adj.)* TC036
Henle's loop *(n.)* FF044
henry *(n.)* KG036
Henry's law *(n.)* DD040
hepat AL170
hepatic *(adj.)* MA104
Hepaticae *(n.pl.)* CB079
hepatic caecum *(n.)* MF048
hepatic duct *(n.)* MA112
hepatic portal system *(n.)* PA040
hepatic sinusoids *(n.pl.)* MA091
hepatitis *(n.)* MA102
hepatopancreas *(n.)* MF051
herb *(n.)* CH005
herbaceous *(adj.)* CH024
herbaceous perennial *(n.)* SD013
herbicide *(n.)* GB052
herbivore *(n.)* MB008
herd *(n.)* GA080
hereditability *(n.)* TA005
hereditable *(adj.)* TA010
hereditary *(adj.)* TA009
heredity *(n.)* TA001
heritable *(adj.)* TA012
hermaphrodite *(n.)* SB045
hertz *(n.)* KG037
hesperidium *(n.)* CE167
Hess's law *(n.)* LD009
heterauxin *(n.)* JA076
hetero- *(pre.)* AL069
heteroauxin *(n.)* JA075
Heterobasidiomycetes *(n.pl.)* CB056
heterocaryon *(n.)* TC051
heterocercal *(adj.)* CF113
heterochlamydeous *(adj.)* SF056
heterochromatin *(n.)* CT047
heterocyclic compound *(n.)* BD055
heterodont *(adj.)* ME106
heterodyne effect *(n.)* NM042
heterodyne reception *(n.)* NM045
heterodyne whistle *(n.)* NM043
heterodyning *(n.)* NM044
heteroecious *(adj.)* SG010
heterogamete *(n.)* SB009
heterogametic *(adj.)* CU037
heterogamy *(n.)* SD021
heterogeneous *(adj.)* KA062
heterogenesis *(n.)* SD019
heterogeny *(n.)* SD022
heterografting *(n.)* GB068
heterogynous *(adj.)* SB091
heterokaryon *(n.)* TC049
Heterometabola *(n.pl.)* SG041
heteromorphic *(adj.)* SD029
heteroplastic *(adj.)* GB080
heterosis *(n.)* FA013
heterosporous *(adj.)* SC041
heterostyly *(n.)* SF164
heterothallic *(adj.)* SB132
heterothallism *(n.)* SB125
heterotrophic *(adj.)* MB020
heterozygosis *(n.)* TC016
heterozygote *(n.)* TC014
heterozygous *(adj.)* TC035
hexa- *(pre.)* AL047
hexacanth *(n.)* SD054
hexaploid *(adj.)* CU033
Hexapoda *(n.pl.)* CC068
hexose[1] *(n.)* (Ch) BD104
hexose[2] *(n.)* (Bio, Ch) MD038
H.F. *(abbr.)* NC018
hiatus *(n.)* CG318
hibernation *(n.)* FA017
hierarchy *(n.)* AC014
higher oxide *(n.)* BD007
high frequency *(n.)* NC017
high tension *(n.)* NJ011
high-voltage accelerator *(n.)* NE047
hilum[1] *(n.)* (Bio) SD101
hilum[2] *(n.)* (Bio) FF018
hind *(adj.)* CJ082
hind-brain *(n.)* HB106
hinder *(v.t.)* FG032
hinge *(n.)* CG190
hinge joint *(n.)* CK127
hip *(n.)* CJ072
hirsute *(adj.)* CF059
Hirudinea *(n.pl.)* CC047
hispid *(adj.)* CE068
hist AL161
histioblast *(n.)* CR056
histiocyte *(n.)* CR055
histogen *(n.)* CS045
histogenesis *(n.)* CS051
histogenetic *(adj.)* CS052
histology *(n.)* CL012
hodoscope *(n.)* NC054
hoe *(n.)* GB035
hoeing *(n.)* GB041
holandric *(adj.)* TC070
holdfast *(n.)* CH037
hole *(n.)* NM058
holo- *(pre.)* AL071
holoblastic *(adj.)* SH025
holobranch *(n.)* MJ052
Holocephali *(n.pl.)* CC145
holocrine *(adj.)* CM046
hologamete *(n.)* SB017
hologamy *(n.)* SA030
hologynic *(adj.)* TC071
Holometabola *(n.pl.)* SG038
holometabolism *(n.)* SG045
holophytic *(adj.)* MB017
Holothuroidea *(n.pl.)* CC118
holozoic *(adj.)* MB018
homeostasis *(n.)* FE003
homo- *(pre.)* AL070
Homobasidiomycetes *(n.pl.)* CB055
homocaryon *(n.)* TC052
homocercal *(adj.)* CF112
homochlamydeous *(adj.)* SF054
homodont *(adj.)* ME105
homogametic *(adj.)* CU036
homogamy *(n.)* SA032
homogenous *(adj.)* KA061
homografting *(n.)* GB067
homoiothermal *(adj.)* FE038
homoiothermic *(adj.)* FE036
homokaryon *(n.)* TC050
homologous[1] *(adj.)* (Bio) CG344
homologous[2] *(adj.)* (Ch) BD069
homologous chromosomes *(n.pl.)* CU022
homologous series *(n.)* BD072
homologue[1] *(n.)* (Bio) CG336
homologue[2] *(n.)* (Bio) TC008
homologue[3] *(n.)* (Ch) BD061
homology *(n.)* CG334

homoplastic *(adj.)* GB079
homosporous *(n.)* SC040
homostyly *(n.)* SF163
homothallic *(adj.)* SB131
homothallism *(n.)* SB124
homozygosis *(n.)* TC017
homozygote *(n.)* TC015
homozygous *(adj.)* TC034
honeycomb bag *(n.)* MF020
hoof *(n.)* CF013
Hooke's law *(n.)* KE006
hookworm *(n.)* CC034
hop *(v.i.)* FC042
horizon *(n.)* FH051
horizontal *(adj.)* AF092
hormone *(n.)* JA014
hormone balance *(n.)* JA016
horn *(n.)* CF002
horny layer *(n.)* CF030
horseshoe crab *(n.)* CC101
horticultural propagation *(n.)* SC075
host[1] *(n.)* (Bio) GA109
host[2] *(n.)* (Bio) GB072
hot cathode *(n.)* NE032
hot-wire instrument *(n.)* NJ097
hovercraft *(n.)* EC062
H.T. *(abbr.)* NJ014
hue *(n.)* ND105
humerus *(n.)* CK093
humidity *(n.)* EE055
humidity control *(n.)* EE065
humified *(adj.)* EE067
humus *(n.)* FH034
Huygens' construction *(n.)* NB026
Huygens' principle of superposition *(n.)* NB032
hyaline cartilage *(n.)* CN030
hybrid *(n.)* TA026
hybridism *(n.)* TA032
hybridization *(n.)* DA032
hybridize *(v.)* TA038
hybrid vigour *(n.)* FA012
hydathode *(n.)* CS026
hydr- *(pre.)* AL103
hydrate *(n.)* DD053
hydrated[1] *(adj.)* (Ch) BG026
hydrated[2] *(adj.)* (Bio, Ch, Ph) KA025
hydrated[3] *(adj.)* (Ch) DD055
hydration *(n.)* DD051
hydrocarbon *(n.)* BD073
hydrocoel *(n.)* CJ002
hydrogel *(n.)* DE026
hydrogenation *(n.)* KA003
hydrogen bond *(n.)* DA009
hydrogen bridge *(n.)* DA010
hydrogen electrode *(n.)* EG052
hydroid *(n.)* SD042
hydrolysis *(n.)* KA029
hydrolytic *(adj.)* MA030
hydrometer *(n.)* KF005
hydronasty *(n.)* FD053
hydrophilic *(adj.)* DE031
hydrophilous *(adj.)* SD093
hydrophobic *(adj.)* DE032
hydrophyte *(n.)* GA135
hydroponics *(n.sing.)* FH059
hydrosere *(n.)* GA158
hydrosol *(n.)* DE023
hydrostatics *(n.sing.)* KF001
hydrotaxis *(n.)* FD005
hydrotropism *(n.)* FD028
hydroxide *(n.)* BD004
Hydrozoa *(n.pl.)* CC010
hygiene *(n.)* JD001
hygienic *(adj.)* JD016
hygro- *(pre.)* AL104
hygrokinesis *(n.)* FD044
hygrometry *(n.)* EE068
hygroscope *(n.)* EE070
hymen *(n.)* SE039
hymenium *(n.)* SF184
Hymenoptera *(n.pl.)* CC074
hymenopterous *(adj.)* CF077
hyoid bone *(n.)* ME038
hypapophysis *(n.)* CK046
hyper- *(pre.)* AL005
hyperfunction *(n.)* FG010
hyperglycaemia *(n.)* MA127
hypermetropia *(n.)* HC081
hyperparasite *(n.)* GA105
hyperplasia *(n.)* FA025
hypersensitive *(adj.)* HA033
hypersonic *(adj.)* NH039
hypertonic *(adj.)* ED021
hypertrophic *(adj.)* FA049
hypertrophied *(adj.)* FA050
hypertrophy *(n.)* FA024
hypha *(n.)* CH039
hypo- *(pre.)* AL004
hypocotyl *(n.)* CH084
hypodermal *(adj.)* CH022
hypodermic *(adj.)* CG020
hypodermis[1] *(n.)* (Bio) CF066
hypodermis[2] *(n.)* (Bio) CH014
hypofunction *(n.)* FG009
hypogeal *(adj.)* FA063
hypogenous *(adj.)* GA123
hypogeous *(adj.)* GA124
hypoglossal nerve *(n.)* HB044
hypoglycaemia *(n.)* MA126
hypogynous *(adj.)* SF029
hypopharyngeal *(adj.)* ME135
hypopharynx *(n.)* ME127
hypophysis *(n.)* HB130
hypostomatous *(adj.)* ME019
hypostome *(n.)* ME009
hypothalamus *(n.)* HB120
hypothesis *(n.)* AM067
hypotonic *(adj.)* ED020
Hyracoidea *(n.pl.)* CC207
hysteresis *(n.)* QB062
hysteresis cycle *(n.)* QB063
hysteresis loop *(n.)* QB064
hysteresis loss *(n.)* QB065

IAA *(abbr.)* JA073
IAN *(abbr.)* JA074
ice point *(n.)* LA012
-icide *(suff.)* AL126
ideal *(adj.)* AC054
ideal gas scale *(n.)* LA008
identical *(adj.)* AP034
identifiable *(adj.)* AP053
identification *(n.)* AP042
identify *(v.t.)* AP049
identity *(n.)* AP037
-iferous *(suff.)* AL120
-iform *(suff.)* AL122

-igerous *(suff.)* AL119
igneous rock *(n.)* FH024
ignite *(v.)* AD058
ileo-colic valve *(n.)* MF035
ileum *(n.)* MF033
ilium *(n.)* CK166
ill health *(n.)* JC013
illness *(n.)* JC003
illustrate *(v.t.)* AQ034
illustration *(n.)* AQ028
image *(n.)* ND007
imaginary *(adj.)* AM065
imago *(n.)* SG013
imitation *(adj.)* AB027
immiscible *(adj.)* BC025
immobile *(adj.)* FB021
immobility *(n.)* FB004
immobilize *(v.t.)* FB018
immune *(adj.)* JB056
immunity *(n.)* JB032
immunity in plants *(n.)* JB035
immunization *(n.)* JB048
immunoglobulin *(n.)* JB046
impact *(n.)* EB025
impair[1] *(v.t.)* (Bio, Ch, Ph) AG116
impair[2] *(v.t.)* (Bio) FG025
impart[1] *(v.t.)* (Bio, Ch, Ph) AG155
impart[2] *(v.t.)* (Ch) BA008
impedance *(n.)* NL039
impedance factor *(n.)* NL044
impel *(v.t.)* AF035
impenetrable *(adj.)* AF142
imperceptible *(adj.)* AN066
imperfect *(adj.)* AC055
imperfection *(n.)* AC047
imperfect machine *(n.)* NA004
impermeable *(adj.)* AF145
impervious[1] *(adj.)* (Bio, Ch, Ph) AF146
impervious[2] *(adj.)* (Bio) FH078
impervious[3] *(adj.)* (Bio) CG162
impinge *(v.i.)* NB051
implantation *(n.)* SJ015
impotent *(adj.)* SB075
imprecise *(adj.)* AN028
impregnate *(v.t.)* AF134
improve *(v.)* AG135
impulse[1] *(n.)* (Bio) CQ050
impulse[2] *(n.)* (Ph) EB021
impure *(adj.)* AB033
impurity *(n.)* AB019
inaccurate *(adj.)* AN029
inactive *(adj.)* FB026
inadequate *(adj.)* AN140
inaudible *(adj.)* HD015
inbreeding *(n.)* SA034
incandescent *(adj.)* LC003
incidence *(n.)* ND019
incise *(v.t.)* AG070
incised *(adj.)* CE097
incisor *(n.)* ME078
inclination[1] *(n.)* (Bio, Ch, Ph) AA065
inclination[2] *(n.)* (Ph) QB039
incline *(v.)* AF005
inclined plane *(n.)* NA024
include *(v.t.)* AE012
inclusive *(adj.)* AE022
incompatibility *(n.)* JB024
incompatible *(adj.)* JB030
Incompletae *(n.pl.)* CB113
incomplete flower *(n.)* SF003
incomplete metamorphosis *(n.)* SG037
inconsistency *(n.)* AN078
increase[1] *(v.t.)* (Bio, Ch, Ph) AG001
increase[2] *(v.i.)* (Bio, Ch, Ph) AG019
increase[3] *(n.)* (Bio, Ch, Ph) AN040
increment *(n.)* AN041
incubate *(v.t.)* SH103
incubation[1] *(n.)* (Bio) SH090
incubation[2] *(n.)* (Bio) JC007
incubation period *(n.)* SH091
incubator *(n.)* SH092
incus *(n.)* HD034
indehiscent *(adj.)* CE172
indentation *(n.)* CG237
independent *(adj.)* AN102
independent assortment *(n.)* TC073
independent variable *(n.)* AN075
indestructible *(adj.)* AG128
indeterminancy principle *(n.)* NC085
index *(n.)* LA042
indicated power *(n.)* NA038
indicator *(n.)* BD036
indigenous *(adj.)* GA046
indigestible *(adj.)* MG032
indispensable *(adj.)* AJ076
indistinct *(adj.)* HC021
induce *(v.t.)* AD017
induced *(adj.)* NK079
induced e.m.f. *(n.)* NK051
induced radioactivity *(n.)* NF004
inducer *(n.)* JC071
inductance *(n.)* NK065
induction[1] *(n.)* (Bio, Ch, Ph) AM009
induction[2] *(n.)* (Bio) SH056
induction coil *(n.)* NK074
induction generator *(n.)* NK088
induction heating *(n.)* NK058
induction motor *(n.)* NK059
inductive *(adj.)* NK078
inductive reactance *(n.)* NL040
inductometer *(n.)* NK068
inductor *(n.)* NK067
indusium *(n.)* SF196
industry *(n.)* AJ082
inelastic *(adj.)* AB069
inelastic collision *(n.)* EB024
inert[1] *(adj.)* (Ch) BC037
inert[2] *(adj.)* (Ch) KA045
inertia *(n.)* EB026
inertial mass *(n.)* EB027
inexact *(adj.)* AN030
infancy *(n.)* FA052
infarct *(n.)* CR072
infarction *(n.)* CR071
infected *(adj.)* JC049
infection *(n.)* JC017
infectious *(adj.)* JC046
infective *(adj.)* JC048
infective hepatitis *(n.)* MA103
infectivity *(n.)* JC026
inference *(n.)* AM006
inferior *(adj.)* CG007
inferior gynoecium *(n.)* SF128
inferior ovary *(n.)* SF122
infertile[1] *(adj.)* (Bio) SB073
infertile[2] *(adj.)* (Bio) FH045
infest *(v.t.)* JD011

infinite dilution *(n.)* EG007
inflammable *(adj.)* AD065
inflammation *(n.)* JC129
inflate *(v.t.)* AG005
inflict *(v.t.)* JC038
inflorescence *(n.)* SF090
influence *(v.t.)* AD016
infra- *(pre.)* AL027
infra-red radiation *(n.)* ND102
infundibulum *(n.)* HB128
infusible *(adj.)* BA021
infusoria *(n.pl.)* CA068
ingest *(v.)* ME047
ingluvies *(n.)* MF015
ingredient *(n.)* AE006
ingrowth *(n.)* CG059
inguinal canal *(n.)* SE029
inhalant[1] *(n.)* (Bio) JC154
inhalant[2] *(adj.)* (Bio) MJ029
inhalation *(n.)* MJ009
inhale *(v.)* MJ022
inherit *(v.t.)* TA008
inheritance *(n.)* TA004
inherited *(adj.)* TA011
inhibit *(v.t.)* AJ027
inhibition *(n.)* HA025
inhibitor *(n.)* PA066
initial *(adj.)* AC028
initial cells *(n.pl.)* CS042
initial velocity *(n.)* EA022
initiate *(v.t.)* AD025
initiator *(n.)* BH007
injure *(v.t.)* AG114
injury *(n.)* JC082
innate *(adj.)* HB200
inner ear *(n.)* HD042
innervation *(n.)* HB012
innominate artery *(n.)* PA068
innominate bone *(n.)* CK176
inoculate *(v.)* JB055
inoculation *(n.)* JB053
inoculum *(n.)* JB054
inorganic *(adj.)* BC020
inorganic nomenclature *(n.)* BD001
in-patient *(n.)* JC142
input *(n.)* NK105
in quadrature *(adj.)* NK124
inquiline *(n.)* GA116
inquire *(v.i.)* AK007
insanitary *(adj.)* JD033
insect *(n.)* CC063
Insecta *(n.pl.)* CC067
insecticide *(n.)* JD038
Insectivora *(n.pl.)* CC198
insert *(v.t.)* AF124
inserted *(adj.)* CG222
insertion[1] *(n.)* (Bio) CG189
insertion[2] *(n.)* (Bio) FB035
in situ *(adv.)* AA005
insoluble *(adj.)* DD030
insomnia *(n.)* JC119
inspiration *(n.)* MJ006
inspire *(v.t.)* MJ025
instability *(n.)* KD006
instantaneous *(adj.)* AH024
instantaneous velocity *(n.)* EA024
instar *(n.)* SG016
instinct *(n.)* HB165
instruct *(v.t.)* AQ026
instruction *(n.)* AQ021
instrument *(n.)* AQ004
insufficient *(adj.)* AN142
insulate[1] *(v.t.)* (Ph) LB007
insulate[2] *(v.t.)* (Ph) NJ084
insulating *(adj.)* NJ087
insulation *(n.)* NJ070
insulator *(n.)* NJ006
insulin *(n.)* MA128
integrated circuit *(n.)* NJ058
integument[1] *(n.)* (Bio) CG252
integument[2] *(n.)* (Bio) SD068
intelligence *(n.)* HB183
intensity[1] *(n.)* (Ph) NB009
intensity[2] *(n.)* (Ph) NH045
intensity of magnetization *(n.)* QB056
intensive property *(n.)* AB057
interaction *(n.)* EB008
intercalary *(adj.)* CG249
intercalated *(adj.)* CG250
intercalated discs *(n.pl.)* CP056
intercellular *(adj.)* CT014
interchange *(v.t.)* AF032
interclavicle *(n.)* CK158
interconnected *(adj.)* AA080
intercostal muscle *(n.)* MJ083
interdigitate *(v.i.)* CG208
interface *(n.)* BF012
interfere *(v.i.)* AJ030
interference[1] *(n.)* (Ph) NH031
interference[2] *(n.)* (Ph) NB030
interference bands *(n.pl.)* NB033
interferometer *(n.)* NB042
interferon *(n.)* JB044
interkinesis *(n.)* CU010
interlace *(v.i.)* CG209
intermediate *(adj.)* AC030
intermedin *(n.)* JA034
intermittent *(adj.)* AH030
internal *(adj.)* CG023
internal auditory meatus *(n.)* HD044
internal-combustion engine *(n.)* NA029
internal digestion *(n.)* MG004
internal energy *(n.)* LD022
internal environment *(n.)* FE001
internal fertilization *(n.)* SB029
internal gills *(n.pl.)* MJ040
internal resistance *(n.)* NJ037
internal respiration *(n.)* MJ012
international temperature scale *(n.)* LA015
internode[1] *(n.)* (Bio) CQ034
internode[2] *(n.)* (Bio) CH083
internuncial neuron *(n.)* HB015
interoceptor *(n.)* HB161
interphase *(n.)* CU009
interpolate *(v.t.)* AN118
interpose *(v.t.)* AF127
interpretation *(n.)* HB175
interrupt *(v.t.)* AH014
intersex *(n.)* SB050
interspecific *(adj.)* CA034
interspersed *(adj.)* CG183
interstice *(n.)* CG291
interstitial *(adj.)* CG303
interstitial compound *(n.)* NN006
intertwine *(v.i.)* CG210
interval[1] *(n.)* (Bio, Ch, Ph) AH004

interval[2] *(n.)* (Ph) NH096
intervertebral discs *(n.pl.)* CK014
intestinal juice *(n.)* MG022
intestine *(n.)* MF029
intracellular *(adj.)* CT012
intracellular digestion *(n.)* MG002
intracellular enzymes *(n.pl.)* MA025
intravenous *(adj.)* JB058
intricate *(adj.)* AJ036
intrinsic *(adj.)* FB065
intrinsic energy *(n.)* LD023
intrinsic semiconductor *(n.)* NM048
introduce *(v.t.)* AF125
intussusception *(n.)* CT036
inulin *(n.)* CS015
in vacuo *(adv.)* KF014
invaginate *(v.t.)* CG263
invalid *(adj.)* AM086
invariable *(adj.)* AN084
invasiveness *(n.)* JC023
inverse square law *(n.)* QA007
inversion *(n.)* TC043
inversion temperature *(n.)* EE031
invertase *(n.)* MA066
Invertebrata *(n.pl.)* CC002
invertebrate *(n.)* CK005
inverter *(n.)* NK116
invest *(v.t.)* CG267
investigate *(v.t.)* AK005
investment *(n.)* CG253
in vitro *(adv.)* CD030
in vivo *(adv.)* CD029
involucre *(n.)* SF075
involuntary action *(n.)* HB182
involuntary muscle *(n.)* CP053
involuted *(adj.)* CG161
involved in *(adj.)* AJ039
iodide *(n.)* BD024
iodination *(n.)* KA017
ion *(n.)* DF005
ion exchange *(n.)* BF010
ion-exchange chromatography *(n.)* EF014
ionic *(adj.)* BD037
ionic bond *(n.)* DA002
ionic crystal *(n.)* DA025
ionic formula *(n.)* DF009
ionic product *(n.)* KB008
ionic product of water *(n.)* KB009
ionic theory *(n.)* DF001
ionization *(n.)* DF002
ionization energy *(n.)* DA014
ionization isomer *(n.)* BE013
ionization potential *(n.)* DA015
ionize *(v.)* DF011
ionized *(adj.)* DF012
ionizing radiation *(n.)* NC007
ionosphere *(n.)* NC048
ionosphere wave *(n.)* NC013
-iparous *(suff.)* AL121
iridescent *(adj.)* AC044
iridophore *(n.)* CT090
iris *(n.)* HC045
iron losses *(n.pl.)* NK077
irradiated *(adj.)* NC008
irradiation *(n.)* NC006
irregular *(adj.)* AN089
irregular flower *(n.)* SF005
irreplaceable *(adj.)* AF053
irrigation *(n.)* GB004
irritability *(n.)* HA001
irritable *(adj.)* HA012
irritant[1] *(n.)* (Bio) HA005
irritant[2] *(adj.)* (Bio) HA013
irritate *(v.t)* HA010
irritated *(adj.)* HA014
irritation *(n.)* HA003
irritative *(adj.)* HA016
ischiopubis *(n.)* CK170
ischium *(n.)* CK167
Islets of Langerhans *(n.pl.)* MA123
iso- *(pre.)* AL006
isoclinal *(n.)* QB042
isodynamic line *(n.)* QB045
isogamete *(n.)* SB007
isogamy *(n.)* SA024
isogonal *(n.)* QB040
isolate *(v.t.)* BB048
isolated *(adj.)* AA055
isolation *(n.)* AA044
isolecithal *(adj.)* SH106
isomer *(n.)* BE012
isomerase *(n.)* MA034
isomeric *(adj.)* BE020
isomerism *(n.)* BE011
isomerous *(adj.)* SF114
isometric contraction *(n.)* CP020
isomorphic *(adj.)* SD030
Isopoda *(n.pl.)* CC060
isopodous *(adj.)* FC056
Isoptera *(n.pl.)* CC089
isothermal *(n.)* EE028
isothermal expansion *(n.)* EE013
isotonic *(adj.)* ED019
isotonic contraction *(n.)* CP019
isotope *(n.)* DB011
isotopic ratio *(n.)* DB012
isotopic weight *(n.)* DB019
issue *(v.i.)* AF098
itch *(n.)* JC121
item *(n.)* AE008
-itis *(suff.)* AL095
-ive *(suff.)* AL113
-ivore *(suff.)* AL124
-ivorous *(suff.)* AL124

jacket *(n.)* AD056
jar *(v.t.)* AG099
jaundice[1] *(n.)* (Bio.) JC131
jaundice[2] *(n.)* (Bio) MA116
jaw *(n.)* ME021
jejunum *(n.)* MF032
jerk *(v.t.)* AG101
jet engine *(n.)* EC016
jet propulsion *(n.)* EC018
jettison *(v.t.)* EC030
join[1] *(v.)* (Bio, Ch, Ph) AA058
join[2] *(n.)* (Bio, Ch, Ph) AA062
joint[1] *(n.)* (Bio, Ch, Ph) AA061
joint[2] *(n.)* (Bio) CK124
jolt *(v.t.)* AG100
joule *(n.)* KG025
Joule-Thomson effect *(n.)* EE030
jugular vein *(n.)* PA071
juice *(n.)* MG019
jump *(v.i.)* FC043
junction *(n.)* AA059
junction diode *(n.)* NM071
junction rectifier *(n.)* NM070

juvenile *(n.)* SG008

kaolin *(n.)* FH042
kary AL154
karyokinesis *(n.)* CU042
karyoplasm *(n.)* CT025
kata- *(pre.)* AL023
kata-thermometer *(n.)* JD009
K-capture *(n.)* NF012
keel[1] *(n.)* (Bio) CK160
keel[2] *(n.)* (Bio) SF041
keeper *(n.)* QB013
Kellner-Solvay process *(n.)* BB110
kelvin *(n.)* KG018
Kelvin effect *(n.)* NJ112
keratin *(n.)* CN019
keratinization *(n.)* CN024
ketone *(n.)* BD081
ketose *(n.)* BD108
key *(n.)* CA021
keyboard scale *(n.)* NH099
keynote *(n.)* NH108
kidney *(n.)* FF017
kidney-shaped *(adj.)* CG144
kilogramme *(n.)* KG016
kin AL148
kinaesthetic *(adj.)* HB169
kinase *(n.)* MA059
kinematics *(n.)* EA018
kinesis *(n.)* FD042
kinetic *(adj.)* FD049
kinetic equation *(n.)* EE002
kinetic friction *(n.)* EC051
kinetics[1] *(n.sing.)* (Ph) EB017
kinetics[2] *(n.sing.)* (Ph) EA019
kinetic theory *(n.)* EE001
kinetin *(n.)* JA082
king-crab *(n.)* CC100
kingdom *(n.)* CA011
kinins *(n.pl.)* JA083
kink *(n.)* CG109
Kirchhoff's laws *(n.pl.)* NJ073
K-line *(n.)* NE062
klinostat *(n.)* JA088
klystron *(n.)* NC038
knee-cap *(n.)* CK122
knob *(n.)* CG065
knowledge *(n.)* AK001
Krebs cycle *(n.)* MA016
Kundt's tube *(n.)* NH070
kwashiorkor *(n.)* JC182

label[1] *(n.)* (Bio, Ch, Ph) AQ033
label[2] *(v.t.)* (Bio, Ch, Ph) AQ036
labellum *(n.)* ME131
labia *(n.pl.)* SE037
labial *(adj.)* ME017
labiate *(adj.)* ME018
labile *(adj.)* KA041
labium *(n.)* ME121
labrum *(n.)* ME120
labrum-epipharynx *(n.)* ME128
lacerate *(v.t.)* JC101
Lacertilia *(n.pl.)* CC162
lachrymal[1] *(n.)* (Bio) CK065
lachrymal[2] *(adj.)* (Bio) HC068
lachrymal duct *(n.)* HC066
lachrymal gland *(n.)* HC064
lachrymatory *(adj.)* HC069

lack (of) *(adj.)* AN139
lacrimal[1] *(n.)* (Bio) CK064
lacrimal[2] *(adj.)* (Bio) HC070
lacrimal duct *(n.)* HC067
lactase *(n.)* MA069
lacteal *(n.)* PA080
lactic acid fermentation *(n.)* MA011
lactoflavin *(n.)* MH074
lactogenic *(adj.)* JA070
lactogenic complex *(n.)* JA064
lactose *(n.)* MD047
lacuna[1] *(n.)* (Bio) CG290
lacuna[2] *(n.)* (Bio) CN066
lacunar[1] *(adj.)* (Bio) CG302
lacunar[2] *(adj.)* (Bio) CN074
lacunose *(adj.)* CN075
laevorotatory *(adj.)* NB086
laevulose *(n.)* MD045
lag[1] *(v.t.)* (Ph) LB006
lag[2] *(v.i.)* (Ph) NL042
lagena *(n.)* HD052
lagged *(adj.)* AD070
lagging *(n.)* LB004
Lagomorpha *(n.pl.)* CC200
lamella[1] *(n.)* (Bio) CG226
lamella[2] *(n.)* (Bio) CN065
lamellae[3] *(n.pl.)* (Bio) SF190
lamellar *(adj.)* CG230
lamellate *(adj.)* CG231
Lamellibranchia *(n.pl.)* CC112
Lamellibranchiata *(n.pl.)* CC111
lamina[1] *(n.)* (Bio) CE045
lamina[2] *(n.)* (Bio) CG325
laminar flow *(n.)* EC073
lamina terminalis *(n.)* HB131
lamination *(n.)* NK047
Lami's theorem *(n.)* KD010
lanceolate *(adj.)* CE101
lancet *(n.)* ME129
land breeze *(n.)* LB010
lanthanides *(n.pl.)* BD043
large intestine *(n.)* MF039
larva[1] *(n.)* (Bio) SG014
larva[2] *(n.)* (Bio) SD045
larval *(adj.)* SG031
larviparous *(adj.)* SG032
larvivarous *(adj.)* SG033
larvule *(n.)* SG015
laryngeal *(adj.)* MJ113
laryngitis *(n.)* MJ112
larynx *(n.)* MJ108
lash *(v.)* FB014
latent *(adj.)* AH015
latent heat *(n.)* LB034
latent period *(n.)* CP023
lateral *(adj.)* CG012
lateral bud *(n.)* CE018
lateral line organ *(n.)* HD011
lateral line system *(n.)* HD009
lateral nerve *(n.)* HB032
latex *(n.)* CS009
latex vessels *(n.pl.)* CS028
laticiferous *(adj.)* CS024
laticifers *(n.pl.)* CS031
Latimeria *(n.sing.)* CC153
lattice *(n.)* BG002
lattice energy *(n.)* DA019
Laue X-ray photograph *(n.)* NE065
law *(n.)* AM066

law of constant composition *(n.)* NN001
law of mass action *(n.)* KB004
1st law of thermodynamics *(n.)* LD014
2nd law of thermodynamics *(n.)* LD015
laws of friction *(n.pl.)* EC055
laws of reflection *(n.pl.)* ND018
lay *(v.t.)* SH101
layer *(n.)* CG171
layering *(n.)* GB060
LCR circuit *(n.)* NL059
leach *(v.t.)* FH076
leaching *(n.)* FH070
lead[1] *(n.)* (Ph) NJ050
lead[2] *(v.i.)* (Ph) NL043
lead chamber process *(n.)* BB108
leaf *(n.)* CE039
leaf base *(n.)* CE040
leaf blade *(n.)* CE046
leaf-fall *(n.)* CE009
leaflet *(n.)* CE047
leaf mosaic *(n.)* CE049
leaf-sheath *(n.)* CE041
leak *(v.)* AF108
leakage current *(n.)* NM109
leap *(v.i.)* FC039
learn *(v.)* HB188
Le Chatelier's principle *(n.)* KB007
Leclanché cell *(n.)* EG057
left-hand rule *(n.)* NK018
legume *(n.)* CE157
Leguminosae *(n.pl.)* CB119
lemma *(n.)* SF078
lengthen *(v.)* AG007
lens[1] *(n.)* (Bio) HC077
lens[2] *(n.)* (Ph) ND048
lens formula *(n.)* ND061
lenticel *(n.)* MJ036
Lenz's law *(n.)* NK053
Lepidoptera *(n.pl.)* CC077
lepidosis *(n.)* CF010
lepidote *(adj.)* CF019
leptotene *(n.)* CU062
lesion *(n.)* JC087
lessen *(v.)* AG032
lethal *(adj.)* TC028
lethargic *(adj.)* FA048
leuco- *(pre.)* AL090
leucocyte *(n.)* CR036
leucocytosis *(n.)* CR086
leucoplast *(n.)* CT079
leucopoiesis *(n.)* CR039
leukaemia *(n.)* CR085
level *(n.)* AN012
lever *(n.)* NA010
leverage *(n.)* NA013
lever balance *(n.)* EB062
Leyden jar *(n.)* QC039
L.F. *(abbr.)* NC022
LH *(abbr.)* JA061
liberate[1] *(v.t.)* (Ch) KA037
liberate[2] *(v.t.)* (Bio, Ch, Ph) AF106
lichen *(n.)* CB069
Lichenes *(n.pl.)* CB068
lichenin *(n.)* CB074
lichenism *(n.)* CB071
lichenization *(n.)* CB070
lie *(v.i.)* FB015
life cycle *(n.)* SG001
life history *(n.)* SG002
lifespan *(n.)* AH008
lift[1] *(n.)* (Ph) KD035
lift[2] *(n.)* (Ph) KD037
ligand *(n.)* DA036
light filter *(n.)* ND088
light reaction *(n.)* MC005
lignification *(n.)* CS021
lignin *(n.)* CS004
ligula *(n.)* ME133
ligule[1] *(n.)* (Bio) SF007
ligule[2] *(n.)* (Bio) CE042
like[1] *(adj.)* (Ph) KD043
like[2] *(adj.)* (Ph) QB028
Liliales *(n.pl.)* CB102
limb *(n.)* CJ067
limit *(n.)* AA011
limited[1] *(adj.)* (Bio, Ch, Ph) AM085
limited[2] *(adj.)* (Ch) BB058
limiting friction *(n.)* EC050
limit of proportionality *(n.)* KE008
linear[1] *(adj.)* (Ch) DC008
linear[2] *(adj.)* (Bio) CE100
line of force *(n.)* NK003
line spectrum[1] *(n.)* (Ph) ND100
line spectrum[2] *(n.)* (Ph) NE061
lingual *(adj.)* ME054
lingual papilla *(n.)* ME034
lining *(n.)* CG261
link[1] *(n.)* (Bio) CG184
link[2] *(n.)* (Ch) BH015
link[3] *(v.)* (Bio) CG207
linkage[1] *(n.)* (Bio) CG203
linkage[2] *(n.)* (Bio) TC057
linkage group *(n.)* TC058
linoleic acid *(n.)* MH054
lip *(n.)* ME006
lip *(affix)* AL163
lipase *(n.)* MA085
lipid *(n.)* MD017
lipin *(n.)* MD018
lipoid[1] *(n.)* (Bio) CT009
lipoid[2] *(adj.)* (Bio) CT016
lipoidaemia *(n.)* MD025
lipoid-protein *(n.)* CT010
lipolytic *(adj.)* MA087
liquefaction *(n.)* EE038
liquefy *(v.t.)* EE044
liquid[1] *(n.)* (Bio, Ch, Ph) AB007
liquid[2] *(n.)* (Ch) BC021
liquid[3] *(adj.)* (Ch) BC022
liquid columns *(n.pl.)* KF021
liquid pressure *(n.)* KF007
lithosere *(n.)* GA159
litter *(n.)* SJ023
littoral *(adj.)* GA200
live[1] *(v.i.)* (Bio, Ch, Ph) AD040
live[2] *(adj.)* (Ph) NK120
liver *(n.)* MA088
liverwort *(n.)* CB081
load *(n.)* NA006
load line *(n.)* NM113
loam *(n.)* FH031
lobed *(adj.)* CE114
lobule *(n.)* MA089
locate *(v.t.)* AA049
location[1] *(n.)* (Bio, Ch, Ph) AA046
location[2] *(n.)* (Ch) EF020
locomotion *(n.)* FC001
locomotive *(n.)* NA028

locomotor *(n.)* FC002
locular *(adj.)* SF147
locule *(n.)* SF145
loculicidal *(adj.)* CE176
loculus *(n.)* SF144
locus *(n.)* TC005
lodicules *(n.pl.)* SF080
lomasome *(n.)* CT063
lomentum *(n.)* CE163
lone *(adj.)* AA054
lone pair *(n.)* DA033
long sight *(n.)* HC082
longi- *(pre.)* AL017
longitudinal *(adj.)* CG050
longitudinal plane *(n.)* CG039
longitudinal wave motion *(n.)* NB004
loop[1] *(n.)* (Bio) CG105
loop[2] *(v.i.)* (Bio) FC020
loop of Henle *(n.)* FF043
lop *(v.t.)* AG074
lope *(v.i.)* FC044
lophophore *(n.)* CK218
lophotrichous *(adj.)* CA076
loss of accommodation *(n.)* HC084
loud *(adj.)* NH073
loudness *(n.)* NH054
low frequency *(n.)* NC021
low tension *(n.)* NJ012
L.T. *(abbr.)* NJ015
LTH *(abbr.)* JA065
lubricate[1] *(v.t.)* (Ph) EC064
lubricate[2] *(v.t.)* (Bio) JC135
lubricating *(adj.)* EC067
lumbar *(adj.)* CK027
lumen[1] *(n.)* (Bio) CG278
lumen[2] *(n.)* (Ph) KG042
lumina *(n.pl.)* CG282
luminescence *(n.)* ND013
luminosity *(n.)* ND104
lump *(n.)* BC007
lung *(n.)* MJ068
lung book *(n.)* MJ089
lush *(adj.)* AN125
lustre *(n.)* BA002
lustrous *(adj.)* BA013
luteal *(adj.)* SB101
luteal phase *(n.)* SB097
luteinizing hormone *(n.)* JA054
lux *(n.)* KG043
luxuriant *(adj.)* AN124
Lycopodiales *(n.pl.)* CB090
Lycopsida *(n.pl.)* CB008
lymph *(n.)* CR006
lymphatic[1] *(adj.)* (Bio) CR012
lymphatic[2] *(n.)* (Bio) PA073
lymphatic system *(n.)* PA072
lymph capillaries *(n.pl.)* PA074
lymph channel *(n.)* PA077
lymph duct *(n.)* PA076
lymph follicle *(n.)* PA087
lymph gland *(n.)* PA086
lymph heart *(n.)* PA078
lymph node *(n.)* PA085
lymphoblast *(n.)* CR046
lymphocyte *(n.)* CR044
lymphoid *(adj.)* CR013
lymphoid organ *(n.)* PA084
lymphoid tissue *(n.)* CR042
lymph sac *(n.)* PA082
lymph sinus *(n.)* PA083
lymph space *(n.)* PA081
lymph vessels *(n.pl.)* PA075
lyophilic *(adj.)* DE029
lyophobic *(adj.)* DE030
lyrate *(adj.)* CE117
lysate *(n.)* CT098
-lyse *(suff.)* AL128
lysigenous *(adj.)* CS033
lysigenous cavity *(n.)* CS029
-lysin *(suff.)* AL128
lysis *(n.)* CT097
-lysis *(suff.)* AL128
lysosome *(n.)* CT067
lysozyme *(n.)* JB041
-lytic *(suff.)* AL128

machine *(n.)* AQ003
machinery *(n.)* NA031
Mach number *(n.)* NH006
macro- *(pre.)* AL073
macroconjugant *(n.)* SB123
macrogamete *(n.)* SB014
macrogametocyte *(n.)* SB019
macrolecithal *(adj.)* SH110
macromere *(n.)* SH017
macronucleus *(n.)* SB128
macronutrients *(n.pl.)* FH011
macrophage *(n.)* CR054
macrophagous *(adj.)* MH027
macroscopic *(adj.)* AN054
macroscopic properties *(n.pl.)* BA025
macrosporangium *(n.)* SC033
macrospore *(n.)* SC027
macrosporophyll *(n.)* SC050
macrostructure *(n.)* BE001
macula[1] *(n.)* (Bio) HC091
macula[2] *(n.)* (Bio) HD055
macula lutea *(n.)* HC092
maggot *(n.)* SG019
magnet *(n.)* QB002
magnetic *(adj.)* QB023
magnetic axis *(n.)* QB006
magnetic circuit *(n.)* QB054
magnetic cycle *(n.)* QB048
magnetic declination *(n.)* QB034
magnetic dip *(n.)* QB037
magnetic domain *(n.)* QB018
magnetic elements *(n.pl.)* QB036
magnetic equator *(n.)* QB043
magnetic field[1] *(n.)* (Ph) QB014
magnetic field[2] *(n.)* (Ph) NK002
magnetic flux *(n.)* NK007
magnetic flux density *(n.)* NK006
magnetic force *(n.)* QB011
magnetic intensity *(n.)* NK011
magnetic length *(n.)* QB007
magnetic meridian *(n.)* QB032
magnetic moment *(n.)* QB008
magnetic needle *(n.)* QB009
magnetic permeability *(n.)* NK012
magnetic polarization *(n.)* QB055
magnetic pole strength *(n.)* QB005
magnetic potential *(n.)* QB060
magnetic quatum number *(n.)* NC076
magnetic saturation *(n.)* QB069
magnetic shielding *(n.)* QB012
magnetic space constant *(n.)* NK013
magnetic storm *(n.)* QB047

magnetic susceptibility *(n.)* QB070
magnetic variation *(n.)* QB035
magnetism *(n.)* QB001
magnetization *(n.)* QB010
magnetize *(v.t.)* QB021
magnetized *(adj.)* QB024
magnetizing force *(n.)* NK010
magneto *(n.)* NK089
magnetometer *(n.)* QB019
magnetomotive force *(n.)* QB059
magnetostriction *(n.)* QB016
magnetron *(n.)* NC035
magnification[1] *(n.)* (Ph) AG024
magnification[2] *(n.)* (Ph) ND009
magnified *(adj.)* AG030
magnify *(v.t.)* AG012
magnitude *(n.)* AN010
mains *(n.pl.)* NK099
maintain *(v.t.)* AJ022
maintenance ration *(n.)* GB025
majority carriers *(n.pl.)* NM063
make-and-break circuit *(n.)* NK026
malaise *(n.)* JC115
malformed *(adj.)* CG351
malfunction *(v.i.)* FG024
malignant *(adj.)* JC041
malleability *(n.)* BA005
malleable *(adj.)* BA016
malleus *(n.)* HD033
Mallophaga *(n.pl.)* CC085
malnutrition *(n.)* MH018
malodorous *(adj.)* HE007
Malpighian body *(n.)* FF045
Malpighian corpuscle *(n.)* FF039
Malpighian layer *(n.)* CF026
Malpighian tubule *(n.)* FF012
maltase *(n.)* MA068
maltose *(n.)* MD048
mamma *(n.)* SE048
mammal *(n.)* CC191
Mammalia *(n.pl.)* CC181
mammalian *(adj.)* CC193
mammary gland *(n.)* SE049
mandible *(n.)* ME117
mane *(n.)* CF048
manifold *(n.)* NA047
manipulate *(v.t.)* AQ024
manipulation *(n.)* AQ019
manna *(n.)* CS013
manner *(n.)* AJ012
mannitol *(n.)* CS014
manometer *(n.)* KF023
mantle[1] *(n.)* (Bio) CG254
mantle[2] *(n.)* (Bio) CK211
mantle cavity *(n.)* CK212
mantle lobes *(n.pl.)* CK213
manufacture *(v.t.)* AJ018
manure *(n.)* GB042
manus *(n.)* CK080
manyplies *(n. sing.)* MF023
marasmus *(n.)* JC183
marcotting *(n.)* GB061
margin *(n.)* CE086
marginal *(adj.)* AA040
marginal placentation *(n.)* SF148
marine *(adj.)* GA059
marrow *(n.)* CN056
marsh *(n.)* GA149
Marsupalia *(n.pl.)* CC187
marsupial *(adj.)* CC192
marsupium *(n.)* SE054
mask *(v.t.)* AK027
Mason psychrometer *(n.)* EE078
mass *(n.)* AB063
mass defect *(n.)* NF036
mass dilatometer *(n.)* LA058
mass-energy equation *(n.)* EC043
massive *(adj.)* BC010
mass number *(n.)* DB017
mass polymerization *(n.)* BH003
mass spectrometer *(n.)* NG001
masticate *(v.)* ME049
Mastigophora *(n.pl.)* CA059
match *(v.)* AP021
mate[1] *(n.)* (Bio) SA012
mate[2] *(v.)* (Bio) SA017
material[1] *(n.)* (Bio, Ch, Ph) AB002
material[2] *(adj.)* (Bio, Ch, Ph) AB031
matrix *(n.)* CN009
matter *(n.)* AB001
maturation *(n.)* FA028
mature[1] *(v.)* (Bio) FA035
mature[2] *(adj.)* (Bio) FA045
maturity *(n.)* FA027
maxilla *(n.)* ME118
maximum and minimum thermometers *(n.pl.)* LA041
maximum density of water *(n.)* KF004
Maxwell's distribution law *(n.)* EE004
McLeod gauge *(n.)* KF026
meagre *(adj.)* AN148
mean coefficient of linear expansion *(n.)* LA048
mean coefficient of liquid expansion *(n.)* LA053
mean free path *(n.)* EE005
measure[1] *(v.t.)* (Bio, Ch, Ph) AN112
measure[2] *(n.)* (Bio) JD037
measurement *(n.)* AN109
meatus *(n.)* CG195
mechanical[1] *(adj.)* (Bio, Ch, Ph) AQ014
mechanical[2] *(adj.)* (Ph) NA062
mechanical advantage *(n.)* NA007
mechanical efficiency *(n.)* NA037
mechanics *(n.sing.)* EB015
mechanism[1] *(n.)* (Bio, Ch, Ph) AQ006
mechanism[2] *(n.)* (Bio) FG016
medial *(adj.)* CG047
median *(adj.)* CG048
median fin *(n.)* CF102
median plane *(n.)* CG037
mediastinum *(n.)* MJ081
mediate *(v.t.)* FG034
medicine *(n.)* JC157
medium[1] *(n.)* (Ph) NB024
medium[2] *(n.)* (Bio) CD028
medium[3] *(adj.)* (Bio, Ch, Ph) CG097
medium frequency *(n.)* NC019
medulla[1] *(n.)* (Bio) CG170
medulla[2] *(n.)* (Bio) FF020
medulla[3] *(n.)* (Bio) CH034
medulla oblongata *(n.)* HB107
medullary canal *(n.)* CN053
medullary membrane *(n.)* CN054
medullary ray *(n.)* PB037
medullary sheath *(n.)* CQ031
medullated *(adj.)* CQ043
medusa *(n.)* SD041

medusoid[1] *(n.)* (Bio) SD043
medusoid[2] *(adj.)* (Bio) SD052
mega- *(pre.)* AL074
megagamete *(n.)* SB015
megagametocyte *(n.)* SB020
megagametogenesis *(n.)* SB026
megalecithal *(adj.)* SH108
megaloblast *(n.)* CR022
megaloblastic anaemia *(n.)* CR087
megamere *(n.)* SH016
meganucleus *(n.)* SB129
megasporangium *(n.)* SC032
megaspore *(n.)* SC026
megasporophyll *(n.)* SC049
meiosis *(n.)* CU006
melan- *(pre.)* AL091
melanin *(n.)* CT092
melanophore *(n.)* CT089
melt[1] *(v.i.)* (Ch, Ph) EE042
melt[2] *(v.t.)* (Ch, Ph) EE043
melting *(n.)* EE033
melting point *(n.)* EE040
member *(n.)* AE009
membrane *(n.)* CG150
membrane bone *(n.)* CN049
membranous *(adj.)* CG157
membranous labyrinth *(n.)* HD049
memory *(n.)* HB176
Mendelian *(adj.)* TA042
Mendelian factor *(n.)* TA041
Mendelism *(n.)* TA039
Mendel's laws *(n.pl.)* TA040
meninges *(n.pl.)* HB085
meningitis *(n.)* HB089
meniscus *(n.)* ED033
menotaxis *(n.)* FD014
menses *(n.pl.)* SB100
menstrual cycle *(n.)* SB098
menstruation *(n.)* SB099
mental *(adj.)* HB192
mer *(n.)* BH010
mer- *(pre.)* AL072
mercury barometer *(n.)* KF029
mercury-in-glass thermometer *(n.)* LA021
mercury-in-steel thermometer *(n.)* LA026
mercury vapour lamp *(n.)* NE017
merge *(v.)* AA076
mericarp *(n.)* CE139
meristele *(n.)* CH055
meristem *(n.)* CS034
meristematic cells *(n.pl.)* CS035
meroblastic *(adj.)* SH026
merocrine *(adj.)* CM047
merogamete *(n.)* SB016
merogamy *(n.)* SA027
merozoite *(n.)* SD036
merozygote *(n.)* TC067
mesarch *(adj.)* CH065
mesencephalon *(n.)* HB068
mesenchyme *(n.)* CN006
mesenteron *(n.)* MF003
mesentery *(n.)* CJ036
mesh *(n.)* AC018
meso- *(pre.)* AL041
mesocarp *(n.)* CE136
mesoderm *(n.)* CJ010
mesogloea *(n.)* CJ006
mesolecithal *(adj.)* SH109
mesonephros *(n.)* FF037
mesophilic *(adj.)* CA080
mesophyll *(n.)* CS061
mesophyte *(n.)* GA133
mesosome *(n.)* CT062
mesothelium *(n.)* CM007
mesothorax *(n.)* CK188
messenger RNA *(n.)* TB008
meta- *(pre.)* AL083
metabolic nucleus *(n.)* CU003
metabolism *(n.)* MA001
metabolite *(n.)* MA002
metabolize *(v.t.)* MA008
metacarpal bones *(n.pl.)* CK104
metacarpals *(n.pl.)* CK103
metacarpus *(n.)* CK102
metacentre *(n.)* KF020
Metachlamydeae *(n.pl.)* CB109
metachronal rhythm *(n.)* FC004
metacromion *(n.)* CK151
metadiscoidal *(adj.)* SJ032
metagenesis *(n.)* SD020
metal *(n.)* BC044
metal crystal *(n.)* BG013
metallic *(adj.)* BC057
metallic bond *(n.)* DA011
metalloid *(n.)* BC046
metal rectifier *(n.)* NK114
metamere *(n.)* CJ050
metameric *(adj.)* CJ060
metamerism *(n.)* CJ048
metamerized *(adj.)* CJ061
metamorphic rock *(n.)* FH026
metamorphose *(v.i.)* SG049
metamorphosis *(n.)* SG035
metanephridium *(n.)* FF010
metanephros *(n.)* FF038
metaphase *(n.)* CU051
metapophysis *(n.)* CK040
metastable *(adj.)* BC009
metatarsal bones *(n.pl.)* CK120
metatarsals *(n.pl.)* CK119
metatarsus *(n.)* CK118
metathalamus *(n.)* HB133
Metatheria *(n.pl.)* CC183
metathorax *(n.)* CK189
metaxylem *(n.)* PB014
metazoa *(n.pl.)* CJ001
metencephalon *(n.)* HB072
meteor *(n.)* EC028
meteorite *(n.)* EC029
meter *(n.)* AQ005
-meter *(suff.)* AL137
method *(n.)* AJ003
method of mixtures *(n.)* LB040
methylation *(n.)* KA019
metre *(n.)* KG015
metre bridge *(n.)* NJ076
-metry *(suff.)* AL139
M.F. *(abbr.)* NC020
micell *(n.)* CT101
micella *(n.)* CT102
micelle *(n.)* CT100
micro- *(pre.)* AL075
microbalance *(n.)* EB064
microcircuit *(n.)* NJ059
microconjugant *(n.)* SB122
microfilariae *(n.pl.)* CC033

microgamete *(n.)* SB013
microgametocyte *(n.)* SB018
microgametogenesis *(n.)* SB025
microgamy *(n.)* SA026
microlecithal *(adj.)* SH107
micromere *(n.)* SH015
micrometer screw gauge *(n.)* EA006
micronucleus *(n.)* SB130
micronutrients *(n.pl.)* FH012
micro-organism *(n.)* CD026
microphagous *(adj.)* MH028
microphone *(n.)* NK038
microplankton *(n.)* GA186
micropyle *(n.)* SD069
microscope *(n.)* ND080
microscopic *(adj.)* AN055
microscopic properties *(n.pl.)* BA032
microsome *(n.)* CT096
microsporangium *(n.)* SC034
microspore *(n.)* SC028
microsporophyll *(n.)* SC051
microwaves *(n.pl.)* NC027
micturation *(n.)* FF050
mid-brain *(n.)* HB111
middle ear *(n.)* HD023
middle lamella *(n.)* CU013
midline *(n.)* CG033
mid-rib *(n.)* CE082
migration *(n.)* GA085
migratory *(adj.)* GA051
mild *(adj.)* BC029
mildew *(n.)* CB043
milk products *(n.pl.)* MH009
milk teeth *(n.pl.)* ME060
milky *(adj.)* DD047
milli- *(pre.)* AL058
milliammeter *(n.)* NJ092
millivoltmeter *(n.)* NJ093
mimicry *(n.)* GA088
mineral *(n.)* BC004
mineral acid *(n.)* BD011
mineralization *(n.)* FH013
mineralocorticoids *(n.pl.)* JA026
mineral oil *(n.)* MD021
mineral salts *(n.pl.)* MH004
minimal stimulus *(n.)* HA007
minimum deviation *(n.)* ND065
minority carriers *(n.pl.)* NM064
minute *(adj.)* CG094
miracidium *(n.)* SD046
mirror *(n.)* ND022
mirror formula *(n.)* ND026
miscible *(adj.)* BC024
missile *(n.)* EC002
mist *(n.)* EE062
mitochondrion *(n.)* CT060
mitosis *(n.)* CU005
mitral valve *(n.)* PA054
mix *(v.)* AE014
mixed nerve *(n.)* HB022
mixture *(n.)* BC042
m.m.f. *(abbr.)* QB061
mnemotaxis *(n.)* FD016
mobile[1] *(adj.)* (Ch, Ph) EB038
mobile[2] *(adj.)* (Ch, Ph) BA022
mobile[3] *(adj.)* (Bio) FB019
mobile[4] *(adj.)* (Bio, Ch, Ph) AB038
mobility *(n.)* FB002
mode *(n.)* AJ010
model *(n.)* AM072
modern *(adj.)* AH047
modify *(v.t)* AF070
modiolus *(n.)* HD066
modulation *(n.)* NM007
module *(n.)* EB030
modulus of elasticity *(n.)* KE013
modulus of rigidity *(n.)* KE016
molal concentration *(n.)* DD009
molality *(n.)* DD019
molar[1] *(adj.)* (Ch) DD036
molar[2] *(n.)* (Bio) ME081
molar concentration *(n.)* DD008
molar conductivity *(n.)* EG004
molar conductivity
at infinite dilution *(n.)* EG008
molar conductivity
at zero concentration *(n.)* EG009
molar conductivity of ions *(n.)* EG010
molar gas constant *(n.)* EE017
molar heat capacity *(n.)* LB032
molar heat of fusion *(n.)* LD017
molar heat of vaporization *(n.)* LD018
molarity *(n.)* DD018
molar volume *(n.)* DD016
mole[1] *(n.)* (Bio, Ch, Ph) KG021
mole[2] *(n.)* (Ch) DD013
molecular *(adj.)* BC018
molecular crystal[1] *(n.)* (Ch) DC020
molecular crystal[2] *(n.)* (Bio, Ch, Ph) BG014
molecular formula *(n.)* BE009
molecular lattice *(n.)* DC004
molicular rotation *(n.)* NB078
molecular theory *(n.)* ED001
molecular weight *(n.)* DC006
molecule *(n.)* BC050
mole fraction *(n.)* ED023
Mollusca *(n.pl.)* CC102
molluscicide *(n.)* JD040
molten *(adj.)* EE045
moment of a couple *(n.)* KD049
moment of a force *(n.)* KD047
moment of inertia[1] *(n.)* (Ph) EB028
moment of inertia[2] *(n.)* (Ph) NB119
momentum *(n.)* EB019
monadelphous *(adj.)* SF176
monandrous *(adj.)* SF172
monandry *(n.)* SA043
monanthous *(adj.)* SF021
mono- *(pre.)* AL042
monoblast *(n.)* CR047
monocarpellary *(adj.)* SF137
monocarpic[1] *(adj.)* (Bio) SD023
monocarpic[2] *(adj.)* (Bio) CE147
monocarpous *(adj.)* SF132
monocercous *(adj.)* CD024
monochasial *(adj.)* SF111
monochasium *(n.)* SF100
Monochlamydeae *(n.pl.)* CB110
monochlamydeous *(adj.)* SF048
monochromatic *(adj.)* NB053
monoclinous *(adj.)* SF032
monocotyledon *(n.)* CB099
Monocotyledoneae *(n.pl.)* CB098
monocotyledonous *(adj.)* SD112
monocular vision *(n.)* HC010
monocyte *(n.)* CR045
monodont *(adj.)* ME111
monoecious *(adj.)* SB035

monogamy *(n.)* SA045
monogastric *(adj.)* FB060
monogynous *(adj.)* SF135
monogyny *(n.)* SA041
monohybrid *(n.)* TA027
monolayer *(n.)* ED043
monomer *(n.)* BH009
monomorphic *(adj.)* SD026
monopetalous *(adj.)* SF064
monophyletic *(adj.)* CA030
monophyodont *(adj.)* ME108
monopodial *(adj.)* CH015
monopodium *(n.)* CH006
monosaccharide[1] *(n.)* (Ch) BD103
monosaccharide[2] *(n.)* (Bio, Ch) MD034
monosepalous *(adj.)* SF068
Monotremata *(n.pl.)* CC186
monotrichous *(adj.)* CA075
monotropic *(adj.)* BE019
monotropy *(n.)* BE005
monozygotic *(adj.)* SJ037
monsoon *(n.)* LB012
moor *(n.)* GA153
mordant *(n.)* BB128
morph AL153
morphological *(adj.)* CD008
morphological heterothallism *(n.)* SB126
morphology *(n.)* CD001
morphoplankton *(n.)* GA189
morse *(n.)* NK032
morse code *(n.)* NK029
mortal *(adj.)* FA041
mortality *(n.)* FA030
morula *(n.)* SH013
mosaic[1] *(n.)* (Bio) CG173
mosaic[2] *(n.)* (Bio) SB048
mosaic[3] *(n.)* (Bio) JC076
mosaic[4] *(n.)* (Ph) NE044
mosaic development *(n.)* SH059
mosaic egg *(n.)* SH098
mosaic image *(n.)* HC032
mosaic vision *(n.)* HC033
mosquito *(n.)* CC079
moss *(n.)* CB083
Moss hygrometer *(n.)* EE074
mossy *(adj.)* CB084
mother *(n.)* SA002
mother liquor *(n.)* BB017
motile *(adj.)* FB020
motility *(n.)* FB003
motion *(n.)* EA001
motionless *(adj.)* AF014
motor[1] *(n.)* (Ph) NA027
motor[2] *(n.)* (Bio) FB030
motor[3] *(n.)* (Ph) EB032
motor effect *(n.)* NK016
motor nerve *(n.)* HB020
motor neuron *(n.)* HB016
mould *(n.)* CB044
moult *(v.i.)* SG027
mount[1] *(v.t.)* (Bio, Ch, Ph) AQ025
mount[2] *(v.t.)* (Ph) NA061
mouth *(n.)* ME001
mouth parts *(n.pl.)* ME116
move[1] *(v.t)* (Bio, Ch, Ph) AF017
move[2] *(v.i.)* (Bio, Ch, Ph) AF054
movement *(n.)* FB001
moving-coil loudspeaker *(n.)* NK036
moving-coil microphone *(n.)* NK041
moving phase *(n.)* EF006
mucilage *(n.)* CS006
mucilaginous *(adj.)* CS025
mucin *(n.)* CM024
mucoid *(adj.)* CM030
mucopolysaccharide *(n.)* CM027
mucoprotein *(n.)* CM025
mucosa *(n.)* CM023
mucous *(adj.)* CM029
mucous membrane *(n.)* CM028
mucus *(n.)* CM022
mulch *(v.t.)* GB016
mule *(n.)* TA031
Müllerian mimicry *(n.)* GA092
multi- *(pre.)* AL067
multicostate *(adj.)* CE089
multinucleate *(adj.)* CT054
multiple fruit *(n.)* CE187
multiple sclerosis *(n.)* HB105
multiply *(v.i.)* AG014
multipolar *(adj.)* CQ020
multivibrator *(n.)* NM120
munch *(v.t.)* ME101
Musci *(n.pl.)* CB082
muscle *(n.)* CP013
muscle-bound *(adj.)* CP030
muscle cell *(n.)* CP054
muscle fibre *(n.)* CP035
muscle tone *(n.)* CP025
muscular *(adj.)* CP028
muscular contraction *(n.)* CP017
muscular tissue *(n.)* CP001
musculature *(n.)* CP015
musculo-epithelial cell *(n.)* CU075
mush *(n.)* MG011
mushroom *(n.)* SC046
music *(n.)* NH075
musical instrument *(n.)* NH076
musical note *(n.)* NH043
musical sound *(n.)* NH012
mutable *(adj.)* TC053
mutant[1] *(n.)* (Bio) TC038
mutant[2] *(adj.)* (Bio) TC054
mutation *(n.)* TC037
mutational *(adj.)* TC056
mutative *(adj.)* TC055
muton *(n.)* TB006
mutual *(adj.)* AP025
mutual characteristics *(n.pl.)* NL023
mutual conductance *(n.)* NL029
mutual inductance *(n.)* NK066
mutual induction *(n.)* NK063
M-value *(n.)* DD020
mycelium *(n.)* CH040
mycetogenetic *(adj.)* CB065
mycetophagous *(adj.)* MH035
mycobiont *(n.)* CB073
mycobiota *(n.pl.)* GA132
mycocriny *(n.)* CB047
mycogenetics *(n.sing.)* CB046
mycoid *(adj.)* CB063
mycology *(n.)* CB045
mycophthorous *(adj.)* CB066
Mycophyta *(n.pl.)* CB042
mycorrhiza *(n.)* GA117
mycosis *(n.)* CH043
mycotic *(adj.)* CB064
mycotrophic *(adj.)* CB067

myel AL164
myelencephalon *(n.)* HB073
myelin *(n.)* CQ036
myelinated *(adj.)* CQ044
myelin sheath *(n.)* CQ037
myeloblast *(n.)* CR041
myelocyte *(n.)* CR040
myeloid tissue *(n.)* CR038
myo AL165
myoblast *(n.)* CP002
myofibrils *(n.pl.)* CP007
myogenesis *(n.)* CP014
myoglobin *(n.)* CR027
myoid *(adj.)* CP044
myolemma *(n.)* CP037
myology *(n.)* CG333
myoneme *(n.)* CP010
myoneural *(adj.)* CP049
myopia *(n.)* HC079
myoplasm *(n.)* CP005
myotome[1] *(n.)* (Bio) CP003
myotome[2] *(n.)* (Bio) CP016
myria- *(pre.)* AL068
myriapod *(n.)* CC066
Myriapoda *(n.pl.)* CC054
myxedema *(n.)* JA039
myxoedema *(n.)* JA038
Myxomycophyta *(n.pl.)* CB011
Myxophyta *(n.pl.)* CB020

NAD *(abbr.)* MA044
NADP *(abbr.)* MA045
naiad *(n.)* SG018
nail *(n.)* CF012
naked *(adj.)* ND116
nannoplankton *(n.)* GA185
nanoplankton *(n.)* GA184
narcoma *(n.)* JC164
narcosis *(n.)* JC159
narcotic *(n.)* JC158
narcotism *(n.)* JC160
nares *(n.pl.)* HE016
nasal cavity *(n.)* HE018
nasal sinus *(n.)* HE020
nastic *(adj.)* FD058
nasty *(n.)* FD050
native *(adj.)* BC017
natural *(adj.)* AB025
natural immunity *(n.)* JB033
natural polymer *(n.)* BH011
natural radioactivity *(n.)* NF002
natural selection *(n.)* RA003
nature[1] *(n.)* (Bio, Ch, Ph) AK002
nature[2] *(n.)* (Bio, Ch, Ph) AB059
nausea *(n.)* JC006
navel *(n.)* SJ012
necessary *(adj.)* AJ071
necessity *(n.)* AJ050
neck *(n.)* ME066
nectar *(n.)* SF045
nectariferous *(adj.)* SF055
nectarivorous *(adj.)* MB023
nectary *(n.)* SF046
need[1] *(n.)* (Bio, Ch, Ph) AJ088
need[2] *(v.t.)* (Bio, Ch, Ph) AJ092
negative[1] *(adj.)* (Bio, Ch, Ph) AN081
negative[2] *(adj.)* (Ph) QC023
negative catalyst *(n.)* UA005
negative crystal *(n.)* NB067
negative glow *(n.)* NE012
negligible *(adj.)* AN067
nekton *(n.)* GA188
nematoblast *(n.)* CU079
nematocyst *(n.)* CU077
Nematoda *(n.pl.)* CC030
nematoid *(adj.)* CG159
Nematomorpha *(n.pl.)* CC037
Nemertea *(n.pl.)* CC028
Nemertinea *(n.pl.)* CC029
neo- *(pre.)* AL086
neon lamp *(n.)* NE019
neon sign *(n.)* NE023
neon tube *(n.)* NE022
neopallium *(n.)* HB139
Neornithes *(n.pl.)* CC176
neoteny *(n.)* SG006
nephric *(adj.)* FF047
nephridiopore *(n.)* FF009
nephridium *(n.)* FF006
nephritic *(adj.)* FF046
nephritis *(n.)* FF031
nephromixium *(n.)* FF016
nephron *(n.)* FF034
nephros *(n.)* FF035
nephrostome *(n.)* FF007
neritic *(adj.)* GA196
nerve *(n.)* CQ023
nerve cell *(n.)* CQ005
nerve centre *(n.)* HB048
nerve cord *(n.)* HB003
nerve ending *(n.)* HB017
nerve fibre *(n.)* CQ024
nerve fibril *(n.)* CQ009
nerve net *(n.)* HB002
nerve root *(n.)* HB025
nervous *(adj.)* CQ038
nervous plexus *(n.)* HB055
nervous system *(n.)* HB001
nervous tissue *(n.)* CQ001
nervuration *(n.)* CF070
nervure *(n.)* CF069
nest *(n.)* SG056
nesting nucleus *(n.)* CU004
nestling *(n.)* SG058
net productivity *(n.)* GA017
network *(n.)* AC015
Neumann's law *(n.)* NK054
neural *(adj.)* CQ039
neural arc *(n.)* HB152
neural arch *(n.)* CK031
neural canal *(n.)* HB100
neural fold *(n.)* HB063
neuralgia *(n.)* HE028
neural groove *(n.)* HB064
neural plate[1] *(n.)* (Bio) HB062
neural plate[2] *(n.)* (Bio) CK033
neural spine *(n.)* CK034
neural tissue *(n.)* CQ002
neural tube *(n.)* HB065
neurapophysis *(n.)* CK036
neurasthenia *(n.)* HE029
neurilemma *(n.)* CQ029
neuritis *(n.)* HE027
neuroblast *(n.)* CQ008
neurochord *(n.)* HB031
neurocoel *(n.)* HB080
neurocranium *(n.)* CK058
neurocyton *(n.)* CQ019

neurofibril *(n.)* CQ010
neuroglia *(n.)* CQ003
neurohumoral *(adj.)* HB170
neuroid *(adj.)* CQ040
neurolemma *(n.)* CQ030
neurology *(n.)* HE026
neuromast *(n.)* HD010
neuromere *(n.)* HB103
neuromuscular *(adj.)* CP048
neuromyal *(adj.)* CP045
neuron *(n.)* CQ006
neurone *(n.)* CQ007
neuron theory *(n.)* CQ047
Neuroptera *(n.pl.)* CC076
neurotransmitter *(n.)* CQ053
neurotrophic *(adj.)* CQ042
neurotropic *(adj.)* CQ041
neurula *(n.)* SH066
neuter *(adj.)* SB066
neutral[1] *(adj.)* (Ch) DD033
neutral[2] *(adj.)* (Ph) NK121
neutral equilibrium *(n.)* KD004
neutralization[1] *(n.)* (Ch) BB006
neutralization[2] *(n.)* (Bio) JB005
neutralize *(v.t.)* BB051
neutral point *(n.)* QB015
neutron *(n.)* DB004
newton *(n.)* KG024
Newtonian mechanics *(n.sing.)* EB018
Newton's first law *(n.)* EB012
Newton's law of cooling *(n.)* LB021
Newton's law of universal gravitation *(n.)* EB043
Newton's laws of motion *(n.pl.)* EB011
Newton's rings *(n.pl.)* NB040
Newton's second law *(n.)* EB013
Newton's third law *(n.)* EB014
niacin *(n.)* MH075
nibble *(v.)* ME096
Nicol prism *(n.)* NB080
nicotinic acid *(n.)* MH064
nictitating membrane *(n.)* HC058
nidation *(n.)* SJ016
nidicolous *(adj.)* SG064
nidifugous *(adj.)* SG065
nidus *(n.)* SG057
night-blindness *(n.)* JC184
nil *(adj.)* AN119
nipple *(n.)* SE052
nitrate *(n.)* BD033
nitration *(n.)* KA013
nitrile *(n.)* BD086
nitrite *(n.)* BD034
nitrogenous *(adj.)* BC015
nitrogenous waste *(n.)* FE008
noble *(adj.)* BC036
nocturnal *(adj.)* FD068
node[1] *(n.)* (Bio) CH082
node[2] *(n.)* (Ph) NH090
node[3] *(n.)* (Ph) NB036
node of Ranvier *(n.)* CQ032
nodule[1] *(n.)* (Bio) CG071
nodule[2] *(n.)* (Bio) CH118
noduliferous *(adj.)* CG087
noise *(n.)* NH013
non-allelomorphic *(adj.)* TC033
non-conducting *(adj.)* NJ088
nonconductor *(n.)* NJ005
non-deciduate *(adj.)* SJ030
non-electrolyte *(n.)* EG023
non-endospermous *(adj.)* SD115
non-glandular *(adj.)* CM043
non-ideal *(adj.)* AC056
non-inflammable *(adj.)* AD066
non-medullated *(adj.)* CQ045
nonmetal *(n.)* BC045
non-motile *(adj.)* FB022
non-myelinated *(adj.)* CQ046
non-polar *(adj.)* DA040
non-porous *(adj.)* AB053
non-septate *(adj.)* CG232
non-specific immunity *(n.)* JB047
non-specific resistance *(n.)* JB043
non-stoichiometric compound *(n.)* NN004
non-viable *(adj.)* SA020
noradrenalin *(n.)* JA030
norm *(n.)* AN073
normal[1] *(adj.)* (Bio, Ch, Ph) AN095
normal[2] *(adj.)* (Bio, Ch, Ph) AF093
normality *(n.)* DD021
normalize *(v.t.)* AN083
normal reaction *(n.)* EB007
normal salt *(n.)* BD015
normoblast *(n.)* CR023
nose *(n.)* HE013
nostril *(n.)* HE015
notation *(n.)* NH105
note *(n.)* NH103
nothing *(n.)* AN044
notochord *(n.)* SH067
nought *(n.)* AN008
nourish *(v.t.)* MB013
nourishment *(n.)* MB004
nozzle *(n.)* NA055
n-p-n transistor *(n.)* NM103
n-type semiconductor *(n.)* NM061
nucellus *(n.)* SD070
nuclear[1] *(adj.)* (Ph) NF044
nuclear[2] *(adj.)* (Bio) CT050
nuclear chain reactions *(n.pl.)* NF043
nuclear energy *(n.)* NF035
nuclear fission *(n.)* NF039
nuclear force *(n.)* NF042
nuclear fusion *(n.)* NF040
nuclear membrane *(n.)* CT026
nuclear reaction *(n.)* NF032
nuclear reticulum *(n.)* CT045
nuclear sap *(n.)* CT027
nuclear spindle *(n.)* CU048
nuclear stability *(n.)* NF041
nucleate *(adj.)* CT051
nuclei *(n.pl.)* CT028
nucleic acid *(n.)* TB001
nucleolus *(n.)* CT043
nucleon *(n.)* NF033
nucleophilic reagent *(n.)* KC003
nucleoplasm *(n.)* CT024
nucleotide *(n.)* TB002
nucleotide pairs *(n.pl.)* TB005
nucleus[1] *(n.)* (Bio) CT023
nucleus[2] *(n.)* (Bio) HB079
nucleus[3] *(n.)* (Ch) DB002
nuclide *(n.)* NF034
Nuda *(n.pl.)* CC018
null *(adj.)* AN120
nursery *(n.)* GB007
nut *(n.)* CE151

nutation *(n.)* CH088
nutrient *(n.)* MB002
nutriment *(n.)* MB003
nutrition *(n.)* MB001
nutritional *(adj.)* MB016
nutritious *(adj.)* MB014
nutritive *(adj.)* MB015
nyctalopia *(n.)* JC185
nyctinasty *(n.)* FD052
nymph *(n.)* SG017

oar *(n.)* FC028
obdiplostemonous *(adj.)* SF175
obesity *(n.)* JC124
obey[1] *(v.t.)* (Bio, Ch, Ph) AP016
obey[2] *(v.t.)* (Bio, Ch, Ph) AM081
objective[1] *(adj.)* (Bio, Ch, Ph) AM058
objective[2] *(n.)* (Ph) ND079
obligate *(adj.)* MJ033
obligate parasite *(n.)* GA107
oblique *(adj.)* AF089
oblique muscle *(n.)* HC062
oblique plane *(n.)* CG042
oblong *(adj.)* CE105
obovate *(adj.)* CE109
obscure[1] *(v.t.)* (Bio, Ch, Ph) AK026
obscure[2] *(adj.)* (Bio, Ch, Ph) AK031
observables *(n.pl.)* AK012
observation *(n.)* AK004
observation terms *(n.pl.)* AK016
observe *(v.t.)* AK023
observer *(n.)* AK020
obsolescence *(n.)* RA011
obsolete[1] *(adj.)* (Bio, Ch, Ph) AH046
obsolete[2] *(adj.)* (Bio) CG352
obstruct *(v.t.)* AJ028
obstructive jaundice *(n.)* MA117
obtain[1] *(v.t.)* (Bio, Ch, Ph) AG149
obtain[2] *(v.t.)* (Bio, Ch, Ph) AJ066
obturatur foramen *(n.)* CK175
occasion *(n.)* AH006
occipital bones *(n.pl.)* CK070
occipital condyle *(n.)* CK071
occiput[1] *(n.)* (Bio) CK069
occiput[2] *(n.)* (Bio) CK194
occupant *(n.)* AA007
occupation *(n.)* AA006
occupy *(v.t.)* AA030
occur *(v.i.)* AD012
occurrence *(n.)* AD003
oceanic *(adj.)* GA197
ocellus *(n.)* HC015
octahedral *(adj.)* DC012
octane number *(n.)* KA050
octave *(n.)* NH109
octo- *(pre.)* AL048
Octopoda *(n.pl.)* CC109
ocular *(adj.)* HC022
ocular spot *(n.)* HC014
oculate *(adj.)* HC023
oculomotor *(adj.)* HC024
oculomotor nerve *(n.)* HB035
Odonata *(n.pl.)* CC087
odontoblast *(n.)* ME076
odontoclast *(n.)* ME077
odontoid *(adj.)* ME114
odontoid process *(n.)* CK022
odontostomatous *(adj.)* ME115
odoriferous *(adj.)* HE006
odour *(n.)* HE004
odourless *(adj.)* HE012
oecad *(n.)* CE007
oedema[1] *(n.)* (Bio) JC127
oedema[2] *(n.)* (Bio) CS058
oesophagus *(n.)* MF006
oestradiol *(n.)* JA056
oestrogen *(n.)* JA055
oestrogenic *(adj.)* JA068
oestrous cycle *(n.)* SB093
oestrus *(n.)* SB094
offspring *(n.)* SA005
ohm *(n.)* KG030
ohmic *(adj.)* NM094
ohmmeter *(n.)* NJ098
Ohm's law *(n.)* NJ038
-oid *(suff.)* AL123
oil[1] *(n.)* (Ch) BD093
oil[2] *(n.)* (Bio) MD020
oil/froth flotation *(n.)* BB094
oil-immersion objective *(n.)* ND082
ointment *(n.)* JC151
olecranon fossa *(n.)* CK106
olecranon process *(n.)* CK096
olefine *(n.)* BD078
olfactory *(adj.)* HE005
olfactory bulb *(n.)* HB136
olfactory capsule *(n.)* CK062
olfactory lobe *(n.)* HB135
olfactory nerve *(n.)* HB033
olfactory organ *(n.)* HE002
oligo- *(pre.)* AL064
Oligochaeta *(n.pl.)* CC046
oligotrophic *(adj.)* GA204
omasum *(n.)* MF021
ommatidium *(n.)* HC028
omni- *(pre.)* AL065
omnivore *(n.)* MB011
omosternum *(n.)* CK156
onchosphere *(n.)* SD053
ontogeny *(n.)* SG003
oocyte *(n.)* SB080
oogamy *(n.)* SA029
oogenesis *(n.)* SB085
oogonium *(n.)* SB082
Oomycetes *(n.pl.)* CB050
oosphere *(n.)* SB140
oospore *(n.)* SB141
ooze *(v.i.)* AF101
opalescent *(adj.)* AC042
opaque *(adj.)* AC040
open bundle *(n.)* PB008
open circuit *(n.)* NJ065
opening *(n.)* CG292
operate *(v.)* AJ015
operation *(n.)* AJ002
operational *(adj.)* AJ032
operative *(adj.)* AJ031
operator gene *(n.)* TC019
operculum *(n.)* MJ044
operon *(n.)* TC021
Ophidia *(n.pl.)* CC160
Ophiuroidea *(n.pl.)* CC117
ophthalmia *(n.)* HC051
ophthalmic *(adj.)* HC026
ophthalmology *(n.)* HC050
ophthalmopod *(n.)* HC031
opisthosoma *(n.)* CK193
opsonic *(adj.)* JB029

opsonin *(n.)* JB007
opsonization *(n.)* JB006
optic *(adj.)* HC025
optical activity *(n.)* NB073
optical centre *(n.)* ND053
optical instrument *(n.)* ND074
optical rotary power *(n.)* NB075
optical rotation *(n.)* NB076
optic axis *(n.)* NB064
optic capsule *(n.)* CK063
optic chiasma *(n.)* HB118
optic disc *(n.)* HC088
optic lobe *(n.)* HB112
optic nerve *(n.)* HB034
optic thalami *(n.pl.)* HB117
optimum *(adj.)* KA040
oral *(adj.)* ME014
oral groove *(n.)* ME010
orbiculate *(adj.)* CE110
orbit[1] *(n.)* (Bio) HC059
orbit[2] *(n.)* (Ph) EC012
orbital *(n.)* DB010
orbital overlap *(n.)* DA022
Orchidales *(n.pl.)* CB103
order[1] *(n.)* (Bio, Ch, Ph) AM052
order[2] *(n.)* (Bio) CA008
order of a lever *(n.)* NA012
ordinary *(adj.)* AM046
ordinary ray *(n.)* NB062
ore *(n.)* BC003
organ[1] *(n.)* (Bio) CG340
organ[2] *(n.)* (Bio) CJ031
organellae *(n.pl.)* CT059
organelle *(n.)* CT058
organic[1] *(adj.)* (Ch) BC019
organic[2] *(adj.)* (Bio) CG347
organic disease *(n.)* JC029
organic nomenclature *(n.)* BD051
organism *(n.)* CG341
organization *(n.)* CL009
organizer *(n.)* SH060
organ of Corti *(n.)* HD082
organogenesis *(n.)* CG343
organology *(n.)* CJ041
organ regeneration *(n.)* FA009
orient *(v.t.)* AF079
orientation *(n.)* FB008
orifice *(n.)* CG294
origin[1] *(n.)* (Bio, Ch, Ph) AH011
origin[2] *(n.)* (Bio) FB034
origin[3] *(n.)* (Bio, Ch, Ph) AN013
originate *(v.)* AF095
ornithine *(n.)* MA096
ornithine cycle *(n.)* MA095
ortho- *(pre.)* AL020
Orthoptera *(n.pl.)* CC088
orthotropous *(adj.)* SD079
os centrale *(n.)* CK079
oscillate *(v.)* AG051
oscillating *(adj.)* NB102
oscillation *(n.)* NB088
oscillator *(n.)* NL057
oscillatory *(adj.)* NB103
oscillatory circuit *(n.)* NL056
osculum *(n.)* CK223
-ose *(suff.)* AL118
os innominatum *(n.)* CK179
-osis *(suff.)* AL094
osmometer *(n.)* ED015
osmoregulation *(n.)* FE002
osmosis *(n.)* ED009
osmotic equation *(n.)* ED013
osmotic pressure *(n.)* ED012
ossein *(n.)* CN017
osseous *(adj.)* CN062
osseous labyrinth *(n.)* HD048
ossification *(n.)* CN076
ossified *(adj.)* CN063
ossify *(v.)* CN082
Osteichthyes *(n.pl.)* CC146
osteitis *(n.)* CN059
osteo AL166
osteoblast *(n.)* CN072
osteoclast *(n.)* CN073
osteocyte *(n.)* CN071
osteology *(n.)* CG305
osteolysis *(n.)* CN081
osteolytic *(adj.)* CN085
osteomalacia[1] *(n.)* (Bio) CN061
osteomalacia[2] *(n.)* (Bio) JC190
osteomyelitis *(n.)* CN060
ostial *(adj.)* CK225
ostiate *(adj.)* CK226
ostiole *(n.)* SF199
ostium[1] *(n.)* (Bio) ME005
ostium[2] *(n.)* (Bio) PA007
ostium[3] *(n.)* (Bio) SE045
otic *(adj.)* HD022
otidium *(n.)* HD006
otoconium *(n.)* HD058
otocyst *(n.)* HD007
otolith *(n.)* HD057
-ous *(suff.)* AL114
outbreeding *(n.)* SA036
outer ear *(n.)* HD018
outgrowth *(n.)* CG058
outline *(n.)* AQ030
out-patient *(n.)* JC143
output *(n.)* NK106
oval *(adj.)* CG130
oval window *(n.)* HD076
ovarian follicle *(n.)* SB084
ovarium *(n.)* SF123
ovary[1] *(n.)* (Bio) SB076
ovary[2] *(n.)* (Bio) SF120
ovate *(adj.)* CE108
overcrowded *(adj.)* JD015
overlap[1] *(n.)* (Bio) CG187
overlap[2] *(v.)* (Bio) CG205
overpotential *(n.)* EG050
overt *(adj.)* TA014
overtones *(n.pl.)* NH047
oviducal gland *(n.)* SE011
oviduct *(n.)* SE009
oviparous *(adj.)* SB089
oviposit *(v.i.)* SE018
oviposition *(n.)* SE017
ovipositor *(n.)* SE013
ovisac *(n.)* SE010
ovogenesis *(n.)* SB086
ovoid *(adj.)* SB092
ovotestis *(n.)* SB051
ovoviviparous *(adj.)* SB090
ovulation *(n.)* SB087
ovule *(n.)* SD064
ovum *(n.)* SB077
oxidant *(n.)* KA066
oxidase *(n.)* MA036

oxidation *(n.)* KA064
oxidation number *(n.)* DC019
oxidation state *(n.)* DC018
oxide *(n.)* BD002
oxidizing agent *(n.)* KA065
oxidizing atmosphere *(n.)* KA067
oxygen debt *(n.)* MA014
oxyntic cells *(n.pl.)* CM040
oxyphilous *(adj.)* GA180
oxyphobe *(n.)* GA140
oxyphyte *(n.)* GA139
oxytocin *(n.)* JA033
ozonolysis *(n.)* KA004

pacemaker *(n.)* PA063
pachytene *(n.)* CU064
pack *(n.)* GA081
packing fraction *(n.)* NF038
pad *(n.)* CF016
paddle[1] *(n.)* (Bio) FC029
paddle[2] *(v.)* (Bio) FC046
paedogenesis *(n.)* SG007
pairing *(n.)* CU059
palaeontology *(n.)* RA013
palate *(n.)* ME027
palea *(n.)* SF079
palisade mesophyll *(n.)* CS063
pallium *(n.)* HB138
pallor *(n.)* JC126
palm *(n.)* CJ070
Palmales *(n.pl.)* CB101
palmar *(adj.)* CJ085
palmate *(adj.)* CE127
palp *(n.)* ME122
palpus *(n.)* ME124
pan *(n.)* EB066
pan- *(pre.)* AL033
pancreas *(n.)* MA121
pancreatic *(adj.)* MA133
pancreatic duct *(n.)* MA124
pancreatic juice *(n.)* MG021
pancreatin *(n.)* MG013
pandemic *(adj.)* JC055
panduriform *(adj.)* CE106
panicle *(n.)* SF092
pantothenic acid *(n.)* MH067
paper chromatography *(n.)* EF010
papilionaceous *(adj.)* SF028
papilla[1] *(n.)* (Bio) CG070
papilla[2] *(n.)* (Bio) FF022
pappus *(n.)* CE168
para- *(pre.)* AL013
parabolic mirror *(n.)* ND025
parachute *(n.)* CE169
paraffin *(n.)* BD077
parallax *(n.)* ND008
parallel[1] *(adj.)* (Bio, Ph, Ch) AF087
parallel[2] *(n.)* (Bio) NJ072
parallel forces *(n.pl.)* KD023
parallelogram of forces *(n.)* KD020
parallel venation *(n.)* CE084
paralysis *(n.)* JC117
paramagnetic *(adj.)* NK020
paramorph *(n.)* CA014
paraphysis *(n.)* SF185
paraplegia *(n.)* CK085
parapodium *(n.)* FC007
parasite *(n.)* GA102
parasitic *(adj.)* GA118
parasympathetic nervous system *(n.)* HB011
parathormone *(n.)* JA025
parathyrin *(n.)* JA028
parathyroid gland *(n.)* JA005
paratonic *(adj.)* FD041
Parazoa *(n.pl.)* CC003
parenchyma[1] *(n.)* (Bio) CS054
parenchyma[2] *(n.)* (Bio) CL006
parenchymal *(adj.)* CS065
parenchymatous *(adj.)* CS066
parenchymatous cells *(n.pl.)* CS055
parent *(n.)* SA004
parentage *(n.)* SA008
parent rock *(n.)* FH050
parietal *(adj.)* CG019
parietal mesoderm *(n.)* CJ011
parietal placentation *(n.)* SF150
paripinnate *(adj.)* CE125
part *(n.)* AE002
parthenocarpy *(n.)* CE134
parthenogenesis *(n.)* SB053
parthenogenetic *(adj.)* SB065
partial *(adj.)* AN018
partials *(n.pl.)* NH050
particle *(n.)* AB014
particular *(adj.)* AM036
partition[1] *(n.)* (Bio) CG223
partition[2] *(n.)* (Ch) EF001
partition chromatography *(n.)* EF009
partition coefficient *(n.)* EF003
partition law *(n.)* EF002
parturition *(n.)* SJ021
pascal *(n.)* KG027
Paschen's law *(n.)* NE004
passage *(n.)* CG194
passage cells *(n.pl.)* CS092
Passeriformes *(n.pl.)* CC177
passerine *(adj.)* CC180
passive *(adj.)* BF019
passive artificial immunity *(n.)* JB040
passive natural immunity *(n.)* JB036
passive transport *(n.)* FE009
paste *(n.)* AB043
pasture *(n.)* GB022
patch *(n.)* AA025
patella *(n.)* CK121
path *(n.)* AA013
path difference *(n.)* NB031
path- *(pre.)* AL093
pathogen *(n.)* JC001
pathogenic *(adj.)* JC051
pathogenicity *(n.)* JC022
pathological *(adj.)* JC050
pathology *(n.)* JC031
patient *(n.)* JC141
pattern *(n.)* AC013
Pauli's exclusion principle *(n.)* NC079
paunch *(n.)* MF018
Paurometabola *(n.pl.)* SG042
paurometabolism *(n.)* SG047
pavement epithelium *(n.)* CM013
p-block elements *(n.pl.)* BD047
PCM *(abbr.)* JC181
p.d. *(abbr.)* NJ013
peak value *(n.)* NJ021
pear-shaped *(adj.)* CG145
peat[1] *(n.)* (Bio) FH035
peat[2] *(n.)* (Bio) GA165

peck *(v.)* ME051
pectase *(n.)* MA071
pectates *(n.pl.)* CS018
pectic compounds *(n.pl.)* CS002
pectin *(n.)* CS003
pectoral *(adj.)* CK162
pectoral fin *(n.)* CF106
pectoral girdle *(n.)* CK141
pectose *(n.)* CS017
pedicel *(n.)* SF010
pedigree *(n.)* TA002
pedipalp *(n.)* CK209
peduncle *(n.)* SF011
peg *(n.)* CG193
pelagic *(adj.)* GA199
pelagic zone *(n.)* GA192
pellagra *(n.)* JC187
pellagra-prevention factor *(n.)* MH076
pellicle *(n.)* CD009
pelliculate *(adj.)* CD023
peltate *(adj.)* CE111
Peltier effect *(n.)* NJ110
pelvic *(adj.)* CK184
pelvic cavity *(n.)* CK178
pelvic fin *(n.)* CF107
pelvic girdle *(n.)* CK165
pelvimetry *(n.)* CK180
pelvis[1] *(n.)* (Bio) CK177
pelvis[2] *(n.)* (Bio) FF023
pencil *(n.)* NB010
pendent *(adj.)* CG089
pendulous *(adj.)* CG090
pendulum *(n.)* NB114
penetrable *(adj.)* AF141
penetrance *(n.)* TC080
penetrate *(v.t.)* AF128
penetrated *(adj.)* AF140
penetrating *(adj.)* AF139
penetration *(n.)* AF136
penis *(n.)* SE019
penta- *(pre.)* AL046
pentadactyl *(adj.)* CK086
pentadactyl limb *(n.)* CK073
pentadelphous *(adj.)* SF179
pentamerous *(adj.)* SF027
pentane-in-glass thermometer *(n.)* LA023
pentode *(n.)* NL012
pentose[1] *(n.)* (Ch) BD105
pentose[2] *(n.)* (Bio, Ch) MD039
penultimate *(adj.)* CJ064
penumbra *(n.)* ND005
pepsin *(n.)* MA078
pepsinogen *(n.)* MA056
peptic cells *(n.pl.)* CM039
peptidase *(n.)* MA073
peptide *(n.)* MG034
peptide bond *(n.)* MG035
peptone *(n.)* MG037
per- *(pre.)* AL018
perceive *(v.t.)* AK022
percentage ionization *(n.)* DF004
percept *(n.)* AK010
perceptible[1] *(adj.)* (Bio, Ch, Ph) AK030
perceptible[2] *(adj.)* (Bio, Ch, Ph) AN058
perch[1] *(n.)* (Bio) FC015
perch[2] *(v.i.)* (Bio) FC018
percolate *(v.i.)* AF059
percussion instruments *(n.pl.)* NH079
perennation *(n.)* SD016
perennial[1] *(adj.)* (Bio) CH029
perennial[2] *(n.)* (Bio) SD012
perfect[1] *(adj.)* (Bio, Ch, Ph) AC053
perfect[2] *(v.t.)* (Bio, Ch, Ph) AD054
perfection *(n.)* AC046
perfect machine *(n.)* NA003
perfoliate *(adj.)* CE112
perforate *(adj.)* AB051
perforated *(adj.)* AB052
perforation *(n.)* CG238
peri- *(pre.)* AL037
perianth *(n.)* SF034
periblem *(n.)* CS046
pericardial cavity *(n.)* PA050
pericardial sinus *(n.)* PA005
pericardium *(n.)* PA051
pericarp *(n.)* CE132
perichaetium *(n.)* SF193
perichondral *(adj.)* CN084
perichondral bone *(n.)* CN050
perichondrium *(n.)* CN042
pericycle *(n.)* CH059
peridium *(n.)* SC053
perigonium *(n.)* SF194
perigynous *(adj.)* SF030
perikaryon *(n.)* CQ014
perilymph *(n.)* HD045
perimysium *(n.)* CP040
perineurium *(n.)* CQ026
period[1] *(n.)* (Bio, Ch, Ph) AH002
period[2] *(n.)* (Ch) BD050
period[3] *(n.)* (Ph) NB117
periodic[1] *(adj.)* (Bio, Ch, Ph) AH029
periodic[2] *(adj.)* (Ph) NB122
periodicity *(n.)* BD041
periodic system *(n.)* BD039
periodic table *(n.)* BD040
periodontal *(adj.)* ME113
periodontal membrane *(n.)* ME075
periosteum *(n.)* CN052
peripheral *(adj.)* CG018
peripheral inhibition *(n.)* HA027
peripheral nerve *(n.)* HB026
peripheral nervous system *(n.)* HB006
periphery *(n.)* CG029
periphloic *(adj.)* CH060
periscope *(n.)* ND033
perish *(v.i.)* AB022
perishable *(adj.)* AB039
perisperm *(n.)* SD109
Perissodactyla *(n.pl.)* CC203
peristalsis *(n.)* MG008
peristomium *(n.)* ME007
peritoneal *(adj.)* CJ029
peritoneal cavity *(n.)* CJ017
peritoneum *(n.)* CJ019
peritonitis *(n.)* CJ022
peritrichous *(adj.)* CA078
perivisceral *(adj.)* CJ028
perivisceral cavity *(n.)* CJ016
perivisceral sinus *(n.)* PA006
permanent[1] *(adj.)* (Bio, Ch, Ph) AH017
permanent[2] *(adj.)* (Ch) BC035
permanent plant tissues *(n.pl.)* CS053
permanent set *(n.)* KE009
permanent teeth *(n.pl.)* ME061
permanent water table *(n.)* FH068
permanent wilting point *(n.)* FH064

permeability *(n.)* AF137
permeable *(adj.)* AF143
permeable membrane *(n.)* ED010
permeate *(v.t.)* AF132
permittivity *(n.)* QC030
pernicious anaemia *(n.)* CR088
peroxidase *(n.)* MA037
peroxide *(n.)* BD008
perpendicular *(adj.)* AF088
perpetual *(adj.)* AH019
persist *(v.i.)* AD047
persistent pulp *(n.)* ME074
perspiration *(n.)* FE026
perturbation *(n.)* AF046
pervade *(v.t.)* AF135
pest *(n.)* GB050
pesticide *(n.)* GB051
petal *(n.)* SF039
petaliferous *(adj.)* SF059
petaloid *(adj.)* SF057
petaloideous *(adj.)* SF058
petiole *(n.)* CE043
petiolule *(n.)* CE044
Pfeffer's osmometer *(n.)* ED016
pH *(n.)* KB011
Phaeophyta *(n.pl.)* CB026
phage *(n.)* JC070
-phage *(suff.)* AC125
phagocytable *(adj.)* CR058
phagocyte *(n.)* CR049
phagocytic *(adj.)* CR057
phagocytism *(n.)* CR051
phagocytolysis *(n.)* CR053
phagocytosis *(n.)* CR050
phagolysis *(n.)* CR052
-phagous *(suff.)* AL125
-phagy *(suff.)* AL125
phalanges *(n.pl.)* CK077
Phanerogamia *(n.pl.)* CB015
pharmaceutical *(adj.)* BC060
pharmaceutical chemical *(n.)* BB084
pharmacology *(n.)* JC149
pharmacy *(n.)* JC148
pharyngitis *(n.)* ME045
pharynx *(n.)* ME136
phase[1] *(n.)* (Ph) NB015
phase[2] *(n.)* (Ch) BF011
phase[3] *(n.)* (Ch) DE008
phase angle *(n.)* NB016
phase difference *(n.)* NB017
phase inverter *(n.)* NL061
phase modulation *(n.)* NM013
phase ratio *(n.)* DE009
phase splitting *(n.)* NK104
phase velocity *(n.)* NB022
phellem *(n.)* CS089
phelloderm *(n.)* CH077
phellogen *(n.)* CS088
phenetic *(adj.)* CA032
phenology *(n.)* FD065
phenomenon *(n.)* AK003
phenotype *(n.)* TC011
pheromone *(n.)* FA014
-phile *(suff.)* AL130
-philic *(suff.)* AL130
-philous *(suff.)* AL130
-phily *(suff.)* AL130
phlebitis *(n.)* CR081
phlegm *(n.)* MJ102
phloem *(n.)* PB017
-phobe *(suff.)* AL129
-phobia *(suff.)* AL129
-phobic *(suff.)* AL129
phobotaxis *(n.)* FD018
Pholidota *(n.pl.)* CC196
phon *(n.)* NH061
phosphagen *(n.)* MA048
phosphatase *(n.)* MA039
phospholipid *(n.)* MD019
phosphorescence *(n.)* ND015
phosphorylation *(n.)* MA029
photo- *(pre.)* AL107
photocell *(n.)* NL069
photochemical cell *(n.)* NL073
photoconductive effect *(n.)* NL065
photoconductor *(n.)* NL068
photodiode *(n.)* NM084
photoelasticity *(n.)* NB060
photo-electric cell *(n.)* NL070
photo-electric effect *(n.)* NL063
photo-electron *(n.)* NL067
photo-emission *(n.)* NL066
photo-emissive *(adj.)* NL084
photo-emitter *(n.)* NL074
photograph *(n.)* ND084
photokinesis *(n.)* FD043
photolithotrophic *(adj.)* MB028
photolysis *(n.)* MC007
photomultiplier *(n.)* NL080
photon *(n.)* NC080
photonasty *(n.)* FD051
photo-organotrophic *(adj.)* MB027
photoperiod *(n.)* FD060
photoperiodism *(n.)* FD061
photophile *(n.)* FD064
photophilous *(adj.)* FD023
photophobe *(n.)* FD020
photophobia *(n.)* FD019
photophobic *(adj.)* FD024
photoreceptor *(n.)* HC013
photoreversible *(adj.)* MC019
photosensitive *(adj.)* NL083
photosynthesis *(n.)* MC001
phototaxis *(n.)* FD003
phototransistor *(n.)* NM106
phototrophic *(adj.)* MB025
phototropism *(n.)* FD026
photovoltaic effect *(n.)* NL064
phycobilins *(n.pl.)* MC014
phycobiont *(n.)* CB072
phycocyanin *(n.)* MC015
phycoerythrin *(n.)* MC016
Phycomycetes *(n.pl.)* CB048
phyletic classification *(n.)* CA018
phyll AL179
phylloclade *(n.)* CH075
phyllode *(n.)* CE076
phyllome *(n.)* CE013
phyllotaxis *(n.)* CE051
phyllotaxy *(n.)* CE054
phylogenetic *(adj.)* SG011
phylogenetic classification *(n.)* CA022
phylogeny[1] *(n.)* (Bio) CA019
phylogeny[2] *(n.)* (Bio) SG004
phylum *(n.)* CA010
physical *(adj.)* AB070
physical adsorption *(n.)* BF003
physical appearance *(n.)* AB071

physical principles *(n.pl.)* AM069
physical property *(n.)* BA001
physician *(n.)* JC139
physiological *(adj.)* FG037
physiological heterothallism *(n.)* SB127
physiology *(n.)* FG022
physisorption *(n.)* BF004
phyto, phyte AL184
phytochrome *(n.)* MC017
phytohormones *(n.pl.)* JA071
phytokinins *(n.pl.)* JA084
phytoma *(n.)* CE005
phytome *(n.)* GA023
phytomer *(n.)* SC073
phytoplankton *(n.)* GA182
pia mater *(n.)* HB087
pianoforte *(n.)* NH080
pi bond *(n.)* DA029
pierce *(v.t.)* AF129
piezo-electric effect *(n.)* NK044
pigment *(n.)* BB129
pileus *(n.)* SF187
piliferous *(adj.)* CF058
piliferous layer *(n.)* CS084
pilus[1] *(n.)* (Bio) CE033
pilus[2] *(n.)* (Bio) CD015
pincer *(n.)* CK207
pineal apparatus *(n.)* HB121
pineal body *(n.)* HB123
pineal eye *(n.)* HB122
pineal gland *(n.)* HB124
pin-eyed *(adj.)* SF171
pinna[1] (Bio, Ch, Ph) AL172
pinna[2] *(n.)* (Bio) CE120
pinna[3] *(n.)* (Bio) HD020
pinnate *(adj.)* CE124
pinnatifid *(adj.)* CE115
pinnatiped *(adj.)* FC057
pinnatisect *(adj.)* CE116
Pinnèr-Stabin osmometer *(n.)* ED018
pinnigrade *(adj.)* FC026
Pinnipedia *(n.pl.)* CC210
pinnule *(n.)* CE121
pinocytosis *(n.)* CT003
pip *(n.)* CE144
pipe *(n.)* AC062
piping *(n.)* AC064
Pisces *(n.pl.)* CC141
piscicolous *(adj.)* GA120
piscivorous *(adj.)* MH033
pistil *(n.)* SF119
pistillate *(adj.)* SD089
pistillidium *(n.)* SF129
piston *(n.)* NA041
pit *(n.)* CG279
pitch[1] *(n.)* (Ph) NA023
pitch[2] *(n.)* (Ph) NH053
pith *(n.)* CH031
Pitot tube *(n.)* EC088
pitressin *(n.)* JA035
pitted thickening *(n.)* PB033
pituitary body *(n.)* HB129
pituitary gland *(n.)* HB127
pituitrin *(n.)* JA031
place *(n.)* AA002
placebo *(n.)* JC156
placenta[1] *(n.)* (Bio) SJ001
placenta[2] *(n.)* (Bio) SF143
placental *(adj.)* SJ027
Placentalia *(n.pl.)* CC194
placentate *(adj.)* SJ028
placentation[1] *(n.)* (Bio) SJ002
placentation[2] *(n.)* (Bio) SF146
Placodermi *(n.pl.)* CC142
placoid scale *(n.)* CF006
plagio- *(pre.)* AL022
plagioclimax *(n.)* GA164
plagiosere *(n.)* GA163
planarian *(n.)* CC026
Planck's constant *(n.)* NC070
Planck's law of radiation *(n.)* NC068
plane of polarization *(n.)* NC003
plane polarization *(n.)* NB056
plank *(n.)* KD025
plankter *(n.)* GA190
plankton *(n.)* GA181
planospore *(n.)* SC025
plant[1] *(n.)* (Bio) CH001
plant[2] *(n.)* (Ch.) BB092
plantigrade *(adj.)* FC023
plant kingdom *(n.)* CB001
plant regeneration *(n.)* FA011
plant sociology *(n.)* GA008
planula *(n.)* SD049
plasm AL162
plasma *(n.)* CR005
plasmagene *(n.)* TC009
plasmalemma *(n.)* CT031
plasma-membrane *(n.)* CT029
plasmic membrane *(n.)* CT030
plasmodesmata *(n.pl.)* CL005
plasmodium *(n.)* CL002
Plasmodroma *(n.pl.)* CA045
plasmolysis *(n.)* CT088
plastic[1] *(adj.)* (Bio, Ch, Ph) AB067
plastic[2] *(adj.)* (Ch) BH023
plastic[3] *(n.)* (Ch) BH018
plasticity[1] *(n.)* (Ch, Ph) KE021
plasticity[2] *(n.)* (Ch) BH021
plasticizer *(n.)* BH022
plastid *(n.)* CT070
platelets *(n.pl)* CR059
platinized electrode *(n.)* EG019
Platyhelminthes *(n.pl.)* CC020
Platyrrhines *(n.pl.)* CC214
plausible *(adj.)* AM041
plectostele *(n.)* CH052
plentiful[1] *(adj.)* (Bio, Ch, Ph) AN131
plentiful[2] *(adj.)* (Ch) BB059
plenty (of) AN129
plerocercoid *(n.)* SD057
plerome *(n.)* CS048
pleura *(n.)* MJ078
pleural cavity[1] *(n.)* (Bio) MJ080
pleural cavity[2] *(n.)* (Bio) CJ018
pleural sac *(n.)* MJ079
pleurisy *(n.)* MJ086
pleuroperitoneum *(n.)* CJ020
plot *(v.t.)* AA029
plough *(n.)* GB036
ploughing *(n.)* GB039
plucked *(adj.)* NH114
plug[1] *(n.)* (Bio) CG192
plug[2] *(n.)* (Ph) NJ047
pluma *(n.)* CF088
plumage *(n.)* CF093
plumbline *(n.)* EB058
plumbrule *(n.)* EB059

plumule *(n.)* SH003
pneumat- *(pre.)* AL100
pneumatophore *(n.)* CH108
pneumo- *(pre.)* AL100
pneumonia *(n.)* MJ084
p-n-p-n junction transistor *(n.)* NM105
p-n-p transistor *(n.)* NM102
pocket valve *(n.)* PA057
pod[1] (Bio, Ch, Ph) AL174
pod[2] *(n.)* (Bio) CE158
podex *(n.)* CF111
podium *(n.)* FC006
podsol *(n.)* FH052
poikilothermal *(adj.)* FE039
poikilothermic *(adj.)* FE037
point *(n.)* AA004
point-contact diode *(n.)* NM082
point-contact photodiode *(n.)* NM085
point discharge *(n.)* QC013
poison *(n.)* JB016
Poisson's ratio *(n.)* KE012
polar *(adj.)* DA039
polar body *(n.)* SB081
polarimeter *(n.)* NB079
polarity *(n.)* QB004
polarity inverter *(n.)* NL060
polarizability *(n.)* QC046
polarization[1] *(n.)* (Ch) EG025
polarization[2] *(n.)* (Ph) NB055
polarize *(v.)* AP022
polarized *(adj.)* QC051
polarizer *(n.)* NB081
polarizing angle *(n.)* NB059
polar liquid *(n.)* DA037
polar solvent *(n.)* DA038
pole[1] *(n.)* (Bio, Ch, Ph) AP005
pole[2] *(n.)* (Ph) QB003
pole[3] *(n.)* (Ph) ND027
pollen *(n.)* SF160
pollen grain *(n.)* SD063
pollen sac *(n.)* SF157
pollen tube *(n.)* SD062
pollex *(n.)* CK075
pollination *(n.)* SD081
polliniferous *(adj.)* SF169
pollinium *(n.)* SF161
pollute *(v.t.)* JD028
polluted *(adj.)* JD034
pollution[1] *(n.)* (Bio) JD019
pollution[2] *(n.)* (Bio, Ch) AA048
poly- *(pre.)* AL066
polyadelphous *(adj.)* SF181
polyandrous *(adj.)* SF174
polyandry *(n.)* SA044
polyanthous *(adj.)* SF023
polycarpellary *(adj.)* SF139
polycarpic[1] *(adj.)* (Bio) SD024
polycarpic[2] *(adj.)* (Bio) CE148
polycarpous *(adj.)* SF134
Polychaeta *(n.pl.)* CC045
polychromatic *(adj.)* NB054
polyembryony *(n.)* SH020
polygamy *(n.)* SA046
polygastric *(adj.)* FB062
polygon of forces *(n.)* KD011
polygynous *(adj.)* SF136
polygyny *(n.)* SA042
polylecithal *(adj.)* SH111
polymerase *(n.)* MA049
polymerization *(n.)* BH002
polymerize *(v.)* BH016
polymer *(n.)* BH001
polymorph *(n.)* CR037
polymorphic[1] *(adj.)* (Ch) BE016
polymorphic[2] *(adj.)* (Bio) SD028
polymorphism[1] *(n.)* (Ch) BE002
polymorphism[2] *(n.)* (Bio) SD018
polymorphonuclear leucocyte *(n.)* CR043
polynucleate *(adj.)* CT055
polyp *(n.)* SD040
polypeptide *(n.)* MG038
Polypetalae *(n.pl.)* CB112
polypetalous *(adj.)* SF061
polyphyletic *(adj.)* CA031
polyphyodont *(adj.)* ME110
polyploid *(adj.)* CU035
polyploidy *(n.)* CU027
polypoid *(adj.)* SD051
polysaccharide[1] *(n.)* (Ch) BD101
polysaccharide[2] *(n.)* (Bio, Ch) MD036
polysepalous *(adj.)* SF065
polyspermous *(adj.)* SD117
polyspermy *(n.)* SH094
polyunsaturated fatty acids *(n.pl.)* MD011
Polyzoa *(n.pl.)* CC048
pome *(n.)* CE193
pomology *(n.)* GB031
pons Varolli *(n.)* HB109
populate *(v.t.)* GA043
population *(n.)* GA011
population cycle *(n.)* GA022
p-orbital *(n.)* DB014
pore *(n.)* CG296
poricidal *(adj.)* CE180
Porifera *(n.pl.)* CC004
porometer *(n.)* FH017
porose *(adj.)* CE179
porous[1] *(adj.)* (Bio, Ch, Ph) AB050
porous[2] *(adj.)* (Bio) CG304
port *(n.)* NA043
portable *(adj.)* AF051
portal of entry *(n.)* JC016
portion *(n.)* AE003
position *(n.)* AA003
position of rest *(n.)* NB097
positive[1] *(adj.)* (Bio, Ch, Ph) AN080
positive[2] *(adj.)* (Ph) QC022
positive column *(n.)* NE010
positive crystal *(n.)* NB066
positive lens *(n.)* ND051
positive rays *(n.pl.)* NE025
positron *(n.)* DB006
positron emission *(n.)* NF011
possess *(v.t.)* AG148
post- *(pre.)* AL080
postaxial *(adj.)* CK088
postcaval vein *(n.)* PA025
posterior *(adj.)* CG006
posterior horn *(n.)* HB096
posterior vena cava *(n.)* PA022
postganglionic *(adj.)* HB060
postganglionic nerve *(n.)* HB028
post office box *(n.)* NJ077
postulate *(n.)* AM004
posture *(n.)* FB005
postzygapophysis *(n.)* CK039
potent *(adj.)* SB069

potential[1] *(adj.)* (Bio, Ch, Ph) AJ074
potential[2] *(n.)* (Bio, Ch, Ph) QA002
potential difference *(n.)* NJ009
potential divider *(n.)* NJ033
potential gradient *(n.)* QC008
potentiometer *(n.)* NJ078
potometer *(n.)* FH016
pouch *(n.)* CG272
pound *(v.t.)* AB046
powder[1] *(n.)* (Bio, Ch, Ph) AB042
powder[2] *(n.)* (Ch) BC008
powder[3] *(v.t.)* (Bio, Ch, Ph) AB047
power *(n.)* NA002
power amplifier *(n.)* NL033
power factor *(n.)* NK108
power gain *(n.)* NM112
power pack *(n.)* NK115
power station *(n.)* NK102
p-p factor *(n.)* MH077
practice *(n.)* GB002
pre- *(pre.)* AL081
preaxial *(adj.)* CK087
precaval vein *(n.)* PA027
preceding *(adj.)* AH044
precipitant *(n.)* DD044
precipitate[1] *(n.)* (Ch) DD043
precipitate[2] *(v.t.)* (Ch) DD045
precipitated *(adj.)* DD046
precipitation *(n.)* JB008
precise *(adj.)* AN020
precision *(n.)* AN003
precursor *(n.)* FG018
predator *(n.)* GA069
predict *(v.t.)* AM075
predominate *(v.t.)* BA009
preen *(v.t.)* CF096
preen gland *(n.)* CF094
prefer *(v.t.)* AJ070
preferential *(adj.)* AJ073
prefix *(n.)* AL002
prefoliation *(n.)* CE019
preganglionic *(adj.)* HB059
preganglionic nerve *(n.)* HB027
pregnancy *(n.)* SJ019
pregnant *(adj.)* SJ034
prehensile *(adj.)* FC058
premaxilla *(n.)* ME119
premolar *(n.)* ME080
preparation *(n.)* AJ006
prepare *(v.t.)* AJ019
prepuce *(n.)* SE020
prerequisite *(n.)* AJ091
preserve *(v.t.)* MH023
pressure *(n.)* KF006
pressure at a point *(n.)* KF008
pressure coefficient of expansion of a gas at constant volume *(n.)* EE011
pressure gauge *(n.)* KF024
pressure law *(n.)* EE012
presumptive *(adj.)* SH063
presumptive area *(n.)* SH049
presumptive region *(n.)* SH048
prevent *(v.t.)* AJ026
prey *(n.sing.)* GA071
prey (up) on *(v.t.)* GA097
prezygapophysis *(n.)* CK038
prickle *(n.)* CE027
primary *(n.)* NK071
primary apical meristem *(n.)* CS041
primary body cavity *(n.)* PA009
primary cell *(n.)* EG045
primary colours *(n.pl.)* ND089
primary endosperm nucleus *(n.)* SD075
primary medullary ray *(n.)* PB038
primary meristem *(n.)* CS036
primary phloem *(n.)* PB020
primary productivity *(n.)* GA015
primary root *(n.)* CH104
primary xylem *(n.)* PB027
Primates *(n.pl.)* CC211
prime mover *(n.)* FB042
primitive *(adj.)* AH045
primitive groove *(n.)* SH038
primitive knot *(n.)* SH040
primitive node *(n.)* SH039
primitive streak *(n.)* SH037
primordial meristem *(n.)* CS040
primordium *(n.)* FG021
principal axis *(n.)* ND052
principal focus *(n.)* ND056
principal quantum number *(n.)* NC074
principal section *(n.)* NB065
Principes *(n.pl.)* CB105
principle *(n.)* AM068
principle of complementarity *(n.)* NC084
principle of equivalance *(n.)* EC040
principle of flotation *(n.)* KF017
principle of moments *(n.)* KD048
principle of reversibility of light *(n.)* ND063
printed circuit *(n.)* NJ057
prisere *(n.)* GA161
pro- *(pre.)* AL079
proamnion *(n.)* SH044
probability *(n.)* AM056
Proboscidea[1] *(n.pl.)* (Bio) CC206
Proboscidea[2] *(n.pl.)* (Bio) CC190
proboscis *(n.)* ME125
procambium *(n.)* PB011
procaryotic *(adj.)* CU039
procedure *(n.)* AJ004
process[1] *(n.)* (Bio, Ch, Ph) AJ001
process[2] *(n.)* (Ch) BB081
process[3] *(n.)* (Bio) CG060
process[4] *(v.t.)* (Ph) NM127
processed food *(n.)* MH020
Prochordata *(n.pl.)* CC121
procoelus *(adj.)* CK030
proctodaeum *(n.)* MF004
procumbent *(adj.)* CH094
procumbent stem *(n.)* CH069
produce[1] *(v.t.)* (Bio, Ch, Ph) AJ020
produce[2] *(v.t.)* (Bio, Ch, Ph) AG010
produce backwards *(v.t.)* AG011
product[1] *(n.)* (Bio, Ch, Ph) AJ007
product[2] *(n.)* (Ch) BB075
production *(n.)* AJ008
production ration *(n.)* GB026
productivity *(n.)* GA014
pro-enzyme *(n.)* MA054
profuse *(adj.)* AN126
progeny *(n.pl.)* SA009
progesterone *(n.)* JA058
progestogen *(n.)* JA059
proglottis *(n.)* CK221

progress *(v.i.)* AG136
project *(v.t.)* AF036
projectile *(n.)* EC001
projection *(n.)* CG069
prokaryotic *(adj.)* CU041
prolactin *(n.)* JA057
proleg *(n.)* FC010
proliferate *(v.i.)* GA045
prolific *(adj.)* AN123
prolong *(v.t.)* AG008
promeristem *(n.)* CS039
prometaphase *(n.)* CU067
prominent *(adj.)* AC026
promote *(v.t.)* AJ016
promoter *(n.)* UA004
pronate *(adj.)* CK091
pronation *(n.)* CK081
pronator *(n.)* CK083
prone *(adj.)* CK089
pronephros *(n.)* FF036
pronucleus *(n.)* SB004
proof-plane *(n.)* QC021
propagate *(v.)* AG089
propagation[1] *(n.)* (Bio) SC074
propagation[2] *(n.)* (Ph) NH007
propagule *(n.)* SC076
propel *(v.t.)* AF037
propellant *(n.)* EC021
propeller *(n.)* AF050
property *(n.)* AB056
prophase *(n.)* CU050
prophylactic *(n.)* JD044
prophylaxis *(n.)* JD036
pro-plastid *(n.)* CT071
proportion *(n.)* AN039
proportional *(adj.)* AP026
proprioceptor *(n.)* HB162
prop roots *(n.pl.)* CH099
propulsion *(n.)* AF048
proscolex *(n.)* SD059
prosencephalon *(n.)* HB067
prosenchyma *(n.)* CS059
prosenchymatous cells *(n.pl.)* CS060
prosoma *(n.)* CK192
prostate gland *(n.)* SE030
prostomium *(n.)* ME008
prostrate *(adj.)* CG028
protandrous *(adj.)* SB062
protandry *(n.)* SD087
protective resemblance *(n.)* GA089
protein *(n.)* MD001
proteinase *(n.)* MA076
protein-calorie malnutrition *(n.)* JC180
protein quality *(n.)* MH005
protein score *(n.)* MH006
proteolytic *(adj.)* MA083
proteose *(n.)* MG036
prothallus *(n.)* SD005
prothorax *(n.)* CK187
prothrombin *(n.)* CR064
protist *(n.)* CA036
Protista *(n.pl.)* CA035
proto- *(pre.)* AL078
Protochordata *(n.pl.)* CC120
protoderm *(n.)* CS050
protogenic solvent *(n.)* DD004
protogynous *(adj.)* SB063
protogyny *(n.)* SD088
proton *(n.)* DB003
protonation *(n.)* KA005
protonema *(n.)* CH042
protonephridium *(n.)* FF002
protophilic solvent *(n.)* DD003
protophloem *(n.)* PB012
protophyta *(n.pl.)* CA037
protophyte *(n.)* CA038
protophyton *(n.)* CA039
protoplasm *(n.)* CT018
protoplasmic *(adj.)* CT048
protoplast *(n.)* CT020
protostele *(n.)* CH049
Prototheria *(n.pl.)* CC182
prototroph *(n.)* CA072
prototype *(n.)* EA002
protoxylem *(n.)* PB013
Protozoa *(n.pl.)* CA042
protozoal *(adj.)* CA049
protozoan[1] *(n.)* (Bio) CA043
protozoan[2] *(adj.)* (Bio) CA048
protozoon *(n.)* CA044
protracted *(adj.)* AH020
protractile *(adj.)* FB028
protractor *(n.)* FB056
protrude[1] *(v.i.)* (Bio) CG078
protrude[2] *(v.)* (Bio) FB011
protuberance *(n.)* CG064
proventriculus *(n.)* MF014
provide *(v.t.)* AJ017
provitamin *(n.)* MH040
proximal *(adj.)* CG016
prune *(v.t.)* AG073
pruning *(n.)* GB059
psalterium *(n.)* MF022
pseudocarp *(n.)* CE192
pseudogamy *(n.)* SA037
pseudopodium[1] *(n.)* (Bio) CD016
pseudopodium[2] *(n.)* (Bio) FC008
pseudotrachea *(n.pl.)* ME132
Psilophytales *(n.pl.)* CB087
Psilopsida[1] *(n.pl.)* (Bio) CB009
Psilopsida[2] *(n.pl.)* (Bio) CB088
Psilotales *(n.pl.)* CB086
psychrometer *(n.)* EE077
psychrophilic *(adj.)* CA082
ptera, pter AL171
Pterapoda *(n.pl.)* CC106
Pteridophyta *(n.pl.)* CB085
Pteropsida *(n.pl.)* CB007
pterygoid *(adj.)* CF075
Pterygota *(n.pl.)* CC069
pterygotous *(adj.)* CF074
ptyalin *(n.)* MA063
p-type semiconductor *(n.)* NM062
ptyxis *(n.)* CE020
puberty *(n.)* FA054
pubes *(n.)* CK173
pubescent *(adj.)* CF060
pubic *(adj.)* CK183
pubic bone *(n.)* CK172
pubic symphysis *(n.)* CK171
pubis *(n.)* CK169
pulley *(n.)* NA017
pulley system *(n.)* NA018
pulmobranchia *(n.)* MJ090
pulmobranchial *(adj.)* MJ093
pulmobranchiate *(adj.)* MJ094

pulmonary *(adj.)* MJ087
pulmonary circulation *(n.)* PA037
pulmonary sac *(n.)* MJ091
Pulmonata *(n.pl.)* CC105
pulp[1] *(n.)* (Bio) ME072
pulp[2] *(n.)* (Bio) CE142
pulp cavity *(n.)* ME073
pulsar *(n.)* NC064
pulsate *(v.i.)* AG055
pulsatile *(adj.)* AG067
pulsating[1] *(adj.)* (Bio, Ch, Ph) AG064
pulsating[2] *(adj.)* (Ch, Ph) KG013
pulsation *(n.)* AG062
pulsative *(adj.)* AG066
pulsatory *(adj.)* AG065
pulse[1] *(n.)* (Bio, Ch, Ph) AG061
pulse[2] *(n.)* (Bio) PA062
pulse[3] *(n.)* (Ph) KG005
pulses *(n.pl.)* MH007
pulverize *(v.t.)* AB048
puncture *(v.t.)* AF130
pungent *(adj.)* HE010
Punnett square *(n.)* TC012
pupa *(n.)* SG020
puparium *(n.)* SG022
pupate *(v.i.)* SG026
pupil *(n.)* HC046
pure *(adj.)* BB055
pure line *(n.)* TA025
pure strain *(n.)* TA022
purification *(n.)* BB032
purified *(adj.)* BB056
purify *(v.t.)* BB050
purity *(n.)* BB034
purulence *(n.)* JC091
purulent *(adj.)* JC104
pus *(n.)* JC089
put forward *(v.t.)* AM077
putrefaction *(n.)* MA012
PWP *(abbr.)* FH066
pyloric sphincter *(n.)* MF016
pylorus *(n.)* MF011
pyramid *(n.)* FF021
pyramid of biomass *(n.)* GA077
pyramid of energy *(n.)* GA078
pyramid of numbers *(n.)* GA076
pyrenoid *(n.)* CT078
pyrexia *(n.)* JC114
pyridoxine *(n.)* MH063
pyriform *(adj.)* CG129
pyrolysis *(n.)* KA035
pyrometry *(n.)* LA044
Pyrrophyta *(n.pl.)* CB036
pyruvic acid *(n.)* MA015

Q-factor *(n.)* NL058
quadrat *(n.)* GA012
quadrate *(n.)* ME025
quadri- *(pre.)* AL054
quadriceps *(n.)* FB072
quadruped *(n.)* FC012
qualitative *(adj.)* AC045
qualitative analysis *(n.)* BB029
qualitative inheritance *(n.)* TA006
quality[1] *(n.)* (Bio, Ch, Ph) AC034
quality[2] *(n.)* (Ph) NE066
quality[3] *(n.)* (Ph) NH055
quantitative *(adj.)* AN053
quantitative analysis *(n.)* BB028
quantitative inheritance *(n.)* TA007
quantity *(n.)* AN031
quantized *(adj.)* NC089
quantum *(n.)* NC069
quantum mechanics *(n.sing.)* NC071
quantum number *(n.)* NC073
quantum shell *(n.)* DB008
quantum theory *(n.)* NC066
quarter-wave plate *(n.)* NB069
quasar *(n.)* NC065
quick *(adj.)* AH027
quiescence *(n.)* FA021
quill *(n.)* CF080
quill feather *(n.)* CF089
quin- *(pre.)* AL055
quinquefoliate *(adj.)* CE129

raceme *(n.)* SF091
racemose *(adj.)* SF109
racemose gland *(n.)* CM034
rachis[1] *(n.)* (Bio) SF017
rachis[2] *(n.)* (Bio) CF081
rachis[3] *(n.)* (Bio) CE122
rachitis *(n.)* JC191
rad *(n.)* KG040
radar *(n.)* NC034
radial *(adj.)* CG045
radial plane *(n.)* CG036
radial symmetry *(n.)* CG031
radian *(n.)* KG022
radiant heat *(n.)* LB013
radiate[1] *(v.)* (Bio) CG122
radiate[2] *(v.)* (Bio, Ch, Ph) AG092
radiate[3] *(v.i.)* (Ph) LB026
radiation *(n.)* LB014
radical *(n.)* BD063
radicle *(n.)* SH004
radio *(n.)* NM001
radioactive constant *(n.)* NF018
radioactive decay *(n.)* NF014
radioactive decay chain *(n.)* NF025
radioactive decay constant *(n.)* NF017
radioactive disintegration *(n.)* NF013
radioactive tracers *(n.pl.)* NF031
radioactive type *(n.)* NF008
radioactivity *(n.)* NF001
radio astronomy *(n.)* NC059
radio frequency[1] *(n.)* (Ph) NC010
radio frequency[2] *(n.)* (Ph) NM010
radio-frequency heating *(n.)* NC043
radio-frequency radiation *(n.)* NC055
radio galaxy *(n.)* NC062
radiograph *(n.)* NE064
radiography *(n.)* NE063
radio interferometer *(n.)* NC058
Radiolaria *(n.pl.)* CA055
radiolarian ooze *(n.)* GA166
radiolucent *(adj.)* NE068
radio opaque *(adj.)* NE069
radio receiver *(n.)* NM003
radio set *(n.)* NM004
radio source *(n.)* NC060
radio star *(n.)* NC061
radio telephone *(n.)* NM006
radio telescope *(n.)* NC057
radio transmitter *(n.)* NM002
radio transparent *(adj.)* NE067
radioulna *(n.)* CK098
radio waves *(n.pl.)* NC009

radio window *(n.)* NC056
radius[1] *(n.)* (Bio) CK095
radius[2] *(n.)* (Bio) CG110
radius of curvature *(n.)* ND029
radius of gyration *(n.)* NB121
radix *(n.)* CG075
radula *(n.)* ME037
rainfall *(n.)* GB009
ram AL181
ramenta *(n.pl.)* CE057
ramentum *(n.)* CE056
ramet *(n.)* GB030
rami communicans *(n.pl.)* HB029
ramiferous *(adj.)* CG219
ramify *(v.i.)* CG215
ramiparous *(adj.)* CG220
ramose *(adj.)* CG218
Ranales *(n.pl.)* CB116
random *(adj.)* AM060
range *(n.)* AA016
ranging *(part.)* AN064
Ranvier's node *(n.)* CQ033
Raoult's law[1] *(n.)* (Ch) DD039
Raoult's law[2] *(n.)* (Ph) ED005
raphe *(n.)* SD067
raphide *(n.)* CS019
rapid *(adj.)* AH025
rare *(adj.)* AN146
rarefaction *(n.)* NH009
rash *(n.)* JC130
rate *(n.)* AN050
rate constant *(n.)* KC006
rate of disintegration *(n.)* NF015
rate of reaction *(n.)* KC005
rate order *(n.)* KC007
ratio *(n.)* AN038
ratites *(n.pl.)* CC178
ravenous *(adj.)* MH029
raw materials *(n.pl.)* BB085
ray[1] *(n.)* (Bio) CG076
ray[2] *(n.)* (Bio) CF108
re- *(pre.)* AL035
reach *(v.t.)* AN051
react *(v.i.)* BB077
reactance *(n.)* NL038
reactant *(n.)* BB073
reaction[1] *(n.)* (Ph) EB006
reaction[2] *(n.)* (Ch) BB072
reaction mechanism *(n.)* KC001
reaction profile *(n.)* KA056
reaction propulsion *(n.)* EC017
reaction type *(n.)* KA001
reactivity *(n.)* KA052
reactor *(n.)* NL045
read *(v.t.)* AN111
reading *(n.)* AN106
reagent *(n.)* BB074
real[1] *(adj.)* (Bio, Ch, Ph) AM063
real[2] *(adj.)* (Ph) ND070
rear *(v.t.)* GB033
reason *(v.i.)* HB190
Réaumur scale *(n.)* LA007
rebound *(v.i.)* KE024
recapitulate *(v.t.)* AM076
recapitulation theory *(n.)* SG005
receptacle[1] *(n.)* (Bio) SF012
receptacle[2] *(n.)* (Bio) SF197
receptaculum chyli *(n.)* PA079
reception *(n.)* NM017
receptor *(n.)* HA023
recessive *(adj.)* TC030
recipient[1] *(n.)* (Bio) GB073
recipient[2] *(n.)* (Bio) JB022
reciprocal *(adj.)* AP024
reciprocal inhibition *(n.)* HA026
reciprocal ohm *(n.)* KG031
reciprocate *(v.i.)* AP015
recognition *(n.)* AP043
recognize *(v.t.)* AP050
recombination *(n.)* TA021
reconcile *(v.t.)* AM020
record *(v.t.)* AN113
recording hygrometer *(n.)* EE081
recover[1] *(v.t.)* (Ch) BB098
recover[2] *(v.i.)* (Bio, Ch, Ph) AG156
rectal *(adj.)* MF052
rectal gland *(n.)* MF042
rectification *(n.)* NK110
rectifier *(n.)* NK113
rectifier cell *(n.)* NL071
rectifying valve *(n.)* NL035
rectilinear *(adj.)* EA013
rectilinear propagation *(n.)* ND002
rectum *(n.)* MF041
rectus muscle *(n.)* HC061
recumbent *(adj.)* FB027
recur[1] *(v.i.)* (Bio, Ch, Ph) AH033
recur[2] *(v.i.)* (Bio, Ch, Ph) AD014
recycling *(n.)* BB121
red algae *(n.pl.)* CB030
red blood cell *(n.)* CR014
redia *(n.)* SD047
red marrow *(n.)* CN058
redox equation *(n.)* KA076
redox potential[1] *(n.)* (Ch) KA074
redox potential[2] *(n.)* (Ch) EG054
redox process *(n.)* KA063
redox reaction *(n.)* KA073
redox series[1] *(n.)* (Ch) KA075
redox series[2] *(n.)* (Ch) EG055
reduce *(v.t.)* AG033
reducing agent *(n.)* KA071
reducing atmosphere *(n.)* KA072
reducing sugar *(n.)* BD106
reduction *(n.)* KA070
reduction division *(n.)* CU054
reed[1] *(n.)* (Bio) MF025
reed[2] *(n.)* (Ph) NH084
reed organ pipe *(n.)* NH086
refer *(v.t.)* AP018
reference *(n.)* AP004
refine[1] *(v.t.)* (Bio, Ch, Ph) AD053
refine[2] *(v.t.)* (Ch) BB049
refined *(adj.)* BB053
reflect[1] *(v.t.)* (Bio, Ch, Ph) AF011
reflect[2] *(v.)* (Ph) ND034
reflecting *(adj.)* ND035
reflecting grating *(n.)* NB048
reflecting surface *(n.)* ND032
reflection[1] *(n.)* (Ph) ND017
reflection[2] *(n.)* (Ph) NH021
reflection factor *(n.)* ND021
reflector *(n.)* ND020
reflex *(adj.)* CG083
reflex action *(n.)* HB153
reflex arc *(n.)* HB154
reforming *(n.)* KA033
refraction[1] *(n.)* (Ph) ND040

refraction[2] *(n.)* (Ph) NH029
refractive index *(n.)* ND042
refractivity *(n.)* AB064
refractometer *(n.)* ND046
refractoriness *(n.)* AB065
refractory[1] *(adj.)* (Ch) BA024
refractory[2] *(adj.)* (Bio) CQ057
refrigerant *(n.)* NA057
refrigeration cycle *(n.)* NA058
refrigerator *(n.)* NA059
refuse *(n.)* JD027
regelation *(n.)* LB038
regenerate *(v.i.)* CJ057
regeneration[1] *(n.)* (Bio) FA006
regeneration[2] *(n.)* (Bio) CQ055
region[1] *(n.)* (Bio, Ch, Ph) AA022
region[2] *(n.)* (Bio) CG163
regional *(adj.)* CG174
regma *(n.)* CE164
Regnault hygrometer *(n.)* EE073
regular[1] *(adj.)* (Bio, Ch, Ph) AA039
regular[2] *(adj.)* (Bio, Ch, Ph) AN088
regular[3] *(adj.)* (Ph) ND036
regular flower *(n.)* SF004
regulate *(v.t.)* AJ024
regulator gene *(n.)* TC020
regurgitate *(v.t.)* MG024
reject *(v.t.)* AG153
relapse *(n.)* JC010
relate *(v.t.)* AN012
relation *(n.)* AP001
relation of quantum numbers *(n.)* NC078
relationship *(n.)* AP002
relative *(adj.)* AP023
relative atomic mass *(n.)* DB020
relative density[1] *(n.)* (Ph) KF003
relative density[2] *(n.)* (Ch, Ph) BA027
relative formula mass *(n.)* ED024
relative humidity *(n.)* EE058
relative isotopic mass *(n.)* DB018
relative molecular mass *(n.)* DC005
relative permeability *(n.)* NK014
relative permittivity *(n.)* QC031
relative vapour density *(n.)* ED026
relative velocity *(n.)* EA033
relativistic mass *(n.)* EC045
relativistic mechanics *(n.sing.)* EC039
relativistic particle *(n.)* EC046
relativistic velocity *(n.)* EC047
relativity *(n.)* EC035
relaxation *(n.)* CP021
relay *(n.)* NK025
release *(v.t.)* AF105
releaser *(n.)* HB166
relic *(n.)* GA040
relic distribution *(n.)* GA041
reluctance *(n.)* QB057
reluctivity *(n.)* QB058
rem *(abbr.)* KG039
remanence *(n.)* QB067
remember *(v.)* HB191
remove *(v.t.)* AF026
ren AL167
renal *(adj.)* FF032
renal portal system *(n.)* PA041
renew *(v.t.)* AG142
reni AL167
reniculus *(n.)* FF024
reniform *(adj.)* CG126
rennin *(n.)* MA077
repeat *(v.t.)* AH034
repel *(v.t.)* AJ068
repellant *(n.)* AJ058
repellent *(adj.)* AJ078
replace[1] *(v.t.)* (Bio, Ch, Ph) AF028
replace[2] *(v.t.)* (Ch) BB039
replaceable[1] *(adj.)* (Bio, Ch, Ph) AF052
replaceable[2] *(adj.)* (Ch) KA024
replication *(n.)* TB015
represent[1] *(v.t.)* (Bio, Ch, Ph) AP052
represent[2] *(v.t.)* (Bio, Ch, Ph) AQ035
repressor *(n.)* TC023
reproduction *(n.)* SA001
reproductive *(adj.)* SA021
reproductiveness *(n.)* SA013
reproductivity *(n.)* SA014
Reptilia *(n.pl.)* CC158
repulse *(v.t.)* AJ069
repulsion[1] *(n.)* (Bio, Ch, Ph) AJ056
repulsion[2] *(n.)* (Bio, Ch, Ph) AJ057
repulsive[1] *(adj.)* (Bio, Ch, Ph) AJ079
repulsive[2] *(adj.)* (Bio, Ch, Ph) AJ080
require *(v.t.)* AJ093
required *(adj.)* AN137
requirement *(n.)* AJ089
requisite *(n.)* AJ090
reservoir of infection *(n.)* JC019
residual air *(n.)* MJ101
residual spraying *(n.)* JD042
residue *(n.)* BB012
resin *(n.)* CS008
resin canals *(n.pl.)* CS027
resinous *(adj.)* CS023
resist *(v.t.)* EB036
resistance[1] *(n.)* (Ph) EB009
resistance[2] *(n.)* (Ph) NJ028
resistance box *(n.)* NJ074
resistance thermometer *(n.)* LA036
resistance wire *(n.)* NJ035
resistivity *(n.)* NJ036
resistor *(n.)* NJ029
resolution of forces *(n.)* KD021
resolve *(v.t.)* KD039
resolving power *(n.)* ND081
resonance[1] *(n.)* (Ph) NB095
resonance[2] *(n.)* (Ph) NH017
resonant *(adj.)* NB111
resonant cavity *(n.)* NC037
resonant circuits *(n.pl.)* NL053
resonating *(adj.)* NB110
respiration *(n.)* MJ001
respiratory *(adj.)* MJ027
respiratory centre *(n.)* MJ004
respiratory heart *(n.)* PA044
respiratory movement *(n.)* MJ003
respiratory organ *(n.)* MJ016
respiratory pigment *(n.)* MJ018
respiratory quotient *(n.)* MJ019
respiratory rate *(n.)* MJ096
respiratory ratio *(n.)* MJ020
respiratory surface *(n.)* MJ017
respiratory tract *(n.)* MJ074
respire *(v.i.)* MJ021
respired *(adj.)* MJ028
response *(n.)* HA018
responsible for *(adj.)* AJ041
rest[1] *(n.)* (Bio, Ch, Ph) AG107

rest[2] *(n.)* (Ph) EB010
rest mass *(n.)* EC044
resting potential *(n.)* CQ051
restitution *(n.)* KE018
restore *(v.t.)* AC022
restoring force *(n.)* EB003
restrain *(v.t.)* EB034
restricted theory of relativity *(n.)* EC038
result[1] *(n.)* (Bio, Ch, Ph) AN107
result[2] *(n.)* (Bio, Ch, Ph) AN108
resultant[1] *(n.)* (Ph) EA009
resultant[2] *(n.)* (Ph) KD018
resultant force *(n.)* KD017
retain *(v.t.)* AG154
retard *(v.t.)* AG145
retardation[1] *(n.)* (Ph) EA029
retardation[2] *(n.)* (Bio, Ch, Ph) AF012
retarder *(n.)* UA003
retch *(v.i.)* MG025
reticular *(adj.)* AC023
reticular cells *(n.pl.)* CR048
reticular tissue *(n.)* CN004
reticulate *(adj.)* AC024
reticulated *(adj.)* AC025
reticulate thickening *(n.)* PB032
reticulate venation *(n.)* CE085
reticulation *(n.)* AC017
reticulin *(n.)* CN016
reticulin fibres *(n.pl.)* CN013
reticulocyte *(n.)* CR016
reticulum *(n.)* MF019
retina *(n.)* HC086
retinol *(n.)* MH042
retinula *(n.)* HC029
retract *(v.)* FB012
retractile *(adj.)* FB029
retractor *(n.)* FB057
retreat *(v.i.)* AG143
retro- *(pre.)* AL028
retro-rocket *(n.)* EC020
reveal *(v.t.)* AK029
reverberation *(n.)* NH026
reverberation time *(n.)* NH027
reverberatory furnace *(n.)* BB096
reverse *(v.t.)* AM057
reverse bias *(n.)* NM075
reverse osmosis *(n.)* ED014
reversible *(adj.)* KA042
reversible gel *(n.)* DE025
reversible reaction *(n.)* KB003
revert *(v.i.)* BE015
revolve *(v.i.)* AF041
Reynold's number *(n.)* EC075
rhabdom *(n.)* HC030
rheo- *(pre.)* AL106
rheoreceptor *(n.)* HE024
rheostat *(n.)* NJ032
rheotaxis *(n.)* FD010
rheotropism *(n.)* FD033
rhiz AL183
rhizocarp *(n.)* CH004
rhizoid *(n.)* CH012
rhizome *(n.)* SC065
rhizomorph *(n.)* CH041
rhizophorous *(adj.)* CH121
Rhizopoda *(n.pl.)* CA054
rhizopodium *(n.)* CD017
rhizosphere *(n.)* GA147
rhizotaxis *(n.)* CH111
Rhodophyceae *(n.pl.)* CB028
Rhodophyta *(n.pl.)* CB027
rhombencephalon *(n.)* HB069
Rhynchocephalia *(n.pl.)* CC164
rhythm *(n.)* FG004
rib *(n.)* CK047
rib-cage *(n.)* CK052
riboflavin *(n.)* MH062
ribonuclease *(n.)* MA051
ribonucleic acid *(n.)* TB010
ribosenucleic acid *(n.)* TB011
ribosome *(n.)* CT064
rickets *(n.sing.)* JC189
rickettsia *(n.)* JC072
rider *(n.)* NH068
ridge *(n.)* CG066
rig *(n.)* SB052
right-hand rule *(n.)* NK056
right-hand screw rule *(n.)* NK004
rigid *(adj.)* CG330
rigid body *(n.)* AB011
rind *(n.)* CE141
ring *(n.)* BD067
ring circuit *(n.)* NK109
riparian *(adj.)* GA061
ripen *(v.i.)* SD111
ripple *(n.)* NK117
r.m.s. *(abbr.)* NJ023
RNA *(abbr.)* TB004
robust *(adj.)* CG098
rock *(n.)* FH023
rocket *(n.)* EC022
rocket engine *(n.)* EC019
rod[1] *(n.)* (Bio) CG114
rod[2] *(n.)* (Bio) HC094
Rodentia *(n.pl.)* CC199
roentgen *(n.)* KG041
rogue *(n.)* TA020
röntgen *(n.)* KG038
Röntgen rays *(n.pl.)* NE058
root[1] *(n.)* (Bio) CH098
root[2] *(n.)* (Bio) ME065
root[3] *(v.i.)* (Bio) CH120
root cap *(n.)* CH113
root hair *(n.)* CH112
rootless *(adj.)* CH122
rootlet *(n.)* CH109
root-mean-square value *(n.)* NJ022
root-mean-square velocity *(n.)* EE003
root pressure *(n.)* FH005
root sheath *(n.)* CH116
root system *(n.)* CH110
root tubercle *(n.)* CH119
Rosaceae *(n.pl.)* CB118
Rosales *(n.pl.)* CB117
rosette *(n.)* CE050
rosette stem *(n.)* CH068
rostellum *(n.)* ME041
rostral *(adj.)* ME057
rostrum *(n.)* ME040
rot[1] *(n.)* (Bio) JC075
rot[2] *(v.i.)* (Bio) FG027
rotary dispersion *(n.)* NB074
rotate *(v.)* AF040
rotation *(n.)* FB048
rotational *(adj.)* EA016
Rotifera *(n.pl.)* CC041
rotor *(n.)* NA053
rouleaux *(n.pl.)* CR024

round window *(n.)* HD077
roundworm *(n.)* CC031
routine *(n.)* AJ005
row *(v.)* FC045
ruderal *(n.)* GA143
rudiment *(n.)* CG339
rudimentary *(adj.)* CG349
ruffle *(v.t.)* CF097
rule[1] *(n.)* (Bio, Ch, Ph) AM015
rule[2] *(n.)* (Ph) EA003
rumen *(n.)* MF017
ruminant *(n.)* MB009
Ruminantia *(n.pl.)* CC208
ruminate *(v.i.)* ME050
run *(v.i.)* FC034
runcinate *(adj.)* CE118
runner *(n.)* SC071
rupture *(v.)* AF131
rust[1] *(n.)* (Ch) BF014
rust[2] *(v.)* (Ch) BF018

sac *(n.)* CG283
saccharase *(n.)* MA067
sacculate *(adj.)* CG301
sacculation *(n.)* CG287
saccule[1] *(n.)* (Bio) CG288
saccule[2] *(n.)* (Bio) HD053
sacculus[1] *(n.)* (Bio) CG284
sacculus[2] *(n.)* (Bio) HD050
sacculus rotundus *(n.)* MF034
sac fungi *(n.pl.)* CB053
sacral *(adj.)* CK028
sacral rib *(n.)* CK051
sacrum *(n.)* CK015
saggital *(adj.)* CG049
saggital plane *(n.)* CG043
sagittate *(adj.)* CE102
saline *(adj.)* GA179
salinity *(n.)* GA148
saliva *(n.)* ME032
salivant *(n.)* ME046
salivary *(adj.)* ME055
salivary glands *(n.pl.)* CM038
salivate *(v.)* ME048
salivation *(n.)* ME042
salt *(n.)* BD014
salt hydrate *(n.)* BD018
saltigrade *(adj.)* FC024
salting out *(n.)* BB123
samara *(n.)* CE152
sample[1] *(n.)* (Bio, Ch, Ph) AP044
sample[2] *(v.t.)* (Bio, Ch, Ph) AP051
sand *(n.)* FH028
sand culture *(n.)* FH057
sandwich compound *(n.)* NN007
sanitary *(adj.)* JD032
sanitation *(n.)* JD018
sanitation control *(n.)* JD043
sap *(n.)* CH033
saprophagous *(adj.)* MB021
saprophyte *(n.)* GA110
saprophytic *(adj.)* GA119
saprozoic *(adj.)* MB022
sapwood *(n.)* CH079
sarcocarp *(n.)* CE140
Sarcodina *(n.pl.)* CA053
sarcolactic acid *(n.)* CP012
sarcolemma *(n.)* CP036
sarcoma *(n.)* JC177
sarcomere *(n.)* CP009
sarcophagous *(adj.)* MH030
sarcoplasm *(n.)* CP006
sarcosomes *(n.pl.)* CP004
sarcostyles *(n.pl.)* CP008
satellite *(n.)* EC009
satiety *(n.)* MH014
saturated[1] *(adj.)* (Ch) DD035
saturated[2] *(adj.)* (Ch) BD097
saturated fatty acids *(n.pl.)* MD009
saturation *(n.)* ND108
saturation
  anode potential *(n.)* NL026
saturation current *(n.)* NL025
saturation vapour pressure *(n.)* EE056
Sauria *(n.pl.)* CC161
saurian *(adj.)* CC171
Sauropsida *(n.pl.)* CC167
sausage-shaped *(adj.)* CG143
savanna *(n.)* GA154
s-block elements *(n.pl.)* BD046
scab *(n.)* JC092
scalar *(n.)* EA008
scalariform *(adj.)* PB041
scalariform thickening *(n.)* PB034
scala tympani *(n.)* HD072
scala vestibuli *(n.)* HD071
scale[1] *(n.)* (Bio, Ch, Ph) AN007
scale[2] *(n.)* (Bio) CF005
scale[3] *(n.)* (Ph) NH094
scale leaf *(n.)* CE072
scalp *(n.)* CJ081
scan *(v.t.)* AG053
scanning *(n.)* NE043
scanty *(adj.)* AN143
scape *(n.)* SF016
Scaphopoda *(n.pl.)* CC114
scapula *(n.)* CK147
scar *(n.)* JC097
scarce *(adj.)* AN145
scar tissue *(n.)* JC098
scatter *(v.t.)* AG083
schizocarpic *(adj.)* CE173
schizogamy *(n.)* SC011
schizogenesis *(n.)* SC009
schizogenous *(adj.)* CS032
schizogony *(n.)* SC010
schizont *(n.)* SD035
schizozoite *(n.)* SD037
Schwann cell *(n.)* CQ035
sciatic *(adj.)* CK182
sciatica *(n.)* CK135
scientific word building *(n.)* AL141
scintillation *(n.)* NF030
scion *(n.)* GB069
sclera *(n.)* HC040
sclereid *(n.)* CS071
sclerenchyma *(n.)* CS067
sclerenchymatous prosenchyma *(n.)* CS069
scleroproteins *(n.pl.)* CN011
sclerosis *(n.)* CN023
sclerotic *(n.)* HC038
sclerotic coat *(n.)* HC039
sclerotic parenchyma *(n.)* CS068
scolex *(n.)* SD060
scolopale *(n.)* HD004
scolophore *(n.)* HD003
scope *(n.)* AA019
-scope *(suff.)* AL138

-scopy *(suff.)* AL140
scorbutic *(adj.)* JC193
Scorpiones *(n.pl.)* CC099
Scorpionidea *(n.pl.)* CC093
scratch[1] *(n.)* (Bio) JC086
scratch[2] *(v.t.)* (Bio) JC102
screen[1] *(n.)* (Ph) ND012
screen[2] *(n.)* (Ch) BB070
screen grid *(n.)* NL018
screw *(n.)* NA021
scrotal sacs *(n.pl.)* SE026
scrotum *(n.)* SE027
scrub *(n.)* GA156
scurvy *(n.)* JC188
scutellum *(n.)* SD106
scyphistoma *(n.)* SD044
Scyphomedusae *(n.pl.)* CC009
Scyphozoa *(n.pl.)* CC008
sea breeze *(n.)* LB011
sea-level *(n.)* FH037
season *(n.)* GB008
sebaceous *(adj.)* CF017
sebaceous gland *(n.)* CF041
sebum *(n.)* CF003
second *(n.)* KG017
secondary *(n.)* NK072
secondary body cavity *(n.)* CJ014
secondary cell *(n.)* EG046
secondary colour *(n.)* ND090
secondary cortex *(n.)* CH076
secondary emission *(n.)* NL005
secondary medullary ray *(n.)* PB039
secondary meristem *(n.)* CS037
secondary phloem *(n.)* PB021
secondary productivity *(n.)* GA018
secondary thickening *(n.)* CH035
secondary xylem *(n.)* PB028
second meiotic division *(n.)* CU068
secrete *(v.t.)* CU081
secretin *(n.)* JA048
secretion[1] *(n.)* (Bio) CU070
secretion[2] *(n.)* (Bio) CU071
secretive *(adj.)* CU083
secretory *(adj.)* CU082
secretory trichome *(n.)* CE031
section *(n.)* CG044
secular *(adj.)* QB052
secular depression of zero *(n.)* LA033
secund *(adj.)* SF116
sedentary *(adj.)* FB023
sediment *(n.)* FH033
sedimentary rock *(n.)* FH025
Seebeck effect *(n.)* NJ102
seed[1] *(v.t.)* (Ch) BG022
seed[2] *(n.)* (Bio) SD098
seed-leaf *(n.)* SD110
seedling *(n.)* FA060
seep *(v.i.)* AF133
seepage *(n.)* AF138
see-saw *(n.)* AG059
segment *(n.)* CJ049
segmental *(adj.)* CJ058
segmentation[1] *(n.)* (Bio) CJ047
segmentation[2] *(n.)* (Bio) SH005
segmented *(adj.)* CJ059
segregated *(adj.)* AA056
segregation *(n.)* TC072
seismonasty *(n.)* FD057
seismotaxis *(n.)* FD009
selectance *(n.)* NM025
selection *(n.)* TC079
selection pressure *(n.)* TC082
selectivity[1] *(n.)* (Ph) NM024
selectivity[2] *(n.)* (Bio) FH015
self-differentiation *(n.)* SH058
self-fertile *(adj.)* SB071
self-fertilization *(n.)* SB032
self-inductance *(n.)* NK064
self-induction *(n.)* NK062
self-pollination *(n.)* SD083
self-sterile *(adj.)* SB072
self-sterility *(n.)* SB058
semi- *(pre.)* AL059
semi-circular canal *(n.)* HD060
semiconductor *(n.)* NM047
semiconductor diode *(n.)* NM072
semiconductor junction *(n.)* NM067
semi-lunar valves *(n.pl.)* PA056
semi-micro method *(n.)* BB033
seminal vesicle *(n.)* SE007
seminiferous tubule *(n.)* SE023
semipermeable *(adj.)* AF144
semipermeable membrane *(n.)* ED011
semipolar bond *(n.)* DA008
semitone *(n.)* NH098
senescence *(n.)* FA057
senescent *(adj.)* FA058
senile *(adj.)* FA042
senility *(n.)* FA029
sensation *(n.)* HA020
sense *(n.)* HA019
sense capsules *(n.pl.)* CK061
sense organ *(n.)* HA022
sensibility *(n.)* HA021
sensile *(adj.)* HA031
sensitive[1] *(adj.)* (Bio) HA032
sensitive[2] *(adj.)* (Bio, Ch, Ph) AQ015
sensitivity[1] *(n.)* (Bio) FD001
sensitivity[2] *(n.)* (Ph) EB067
sensory *(adj.)* HA030
sensory adaptation *(n.)* HA029
sensory epithelium *(n.)* CM008
sensory nerve *(n.)* HB018
sensory neuron *(n.)* HB013
sepal *(n.)* SF036
separable *(adj.)* AE019
separate[1] *(v.t.)* (Bio, Ch, Ph) AG081
separate[2] *(v.)* (Bio, Ch, Ph) AE015
separate[3] *(adj.)* (Bio, Ch, Ph) AE018
separated *(adj.)* AE020
separating *(adj.)* BB069
separation *(n.)* BB007
sepsis *(n.)* JC094
septal *(adj.)* CG227
septate *(adj.)* CG228
septic *(adj.)* JC105
septicaemia *(n.)* JC030
septicaemic *(adj.)* JC052
septicidal *(adj.)* CE178
septiform *(adj.)* CG229
septulum *(n.)* CG225
septum *(n.)* CG224
sere *(n.)* GA157
Se reaction *(n.)* KA010
series *(n.)* NJ071
series-wound *(adj.)* NK096

serology *(n.)*	CR010
serotherapy *(n.)*	CR009
serous *(adj.)*	CR011
serous membrane[1] *(n.)* (Bio)	CG153
serous membrane[2] *(n.)* (Bio)	CJ021
serrate *(adj.)*	CE092
serum[1] *(n.)* (Bio)	CR008
serum[2] *(n.)* (Bio.)	JB051
sesamoid bone *(n.)*	CN051
sessile[1] *(adj.)* (Bio)	FB024
sessile[2] *(adj.)* (Bio)	CH017
set[1] *(v.i.)* (Bio, Ch, Ph)	AF061
set[2] *(v.t.)* (Bio, Ch, Ph)	AF076
set[3] *(v.i.)* (Ch)	EE054
seta *(n.)*	CF049
setaceous *(adj.)*	CF052
setiferous *(adj.)*	CF053
setigerous *(adj.)*	CF054
setiparous *(adj.)*	CF057
setule *(n.)*	CF051
set up *(v.t.)*	AQ010
sever *(v.t.)*	AG079
severe *(adj.)*	AG108
sewage *(n.)*	JD026
sewage farm *(n.)*	JD024
sewer *(n.)*	JD022
sewerage *(n.)*	JD023
sex *(n.)*	SB010
sex chromosomes *(n.pl.)*	CU023
sex-limited gene *(n.)*	TC062
sex linkage *(n.)*	TC061
sex organs *(n.pl.)*	SF191
sexuality *(n.)*	SB012
sexual reproduction *(n.)*	SB001
sexual selection *(n.)*	RA004
shade *(n.)*	ND106
shadow *(n.)*	ND003
shaft *(n.)*	CG116
shake *(v.t.)*	AG102
share *(v.t.)*	AG085
shared pair *(n.)*	DA031
share out *(v.t.)*	AG086
sharp[1] *(adj.)* (Bio)	HC020
sharp[2] *(adj.)* (Ph)	ND073
sharp[3] *(#) (adj.)* (Ph)	NH117
shatter *(v.)*	AG096
shave *(v.t.)*	AG076
shear *(n.)*	KE004
shear modulus *(n.)*	KE017
sheath *(n.)*	CG255
shed[1] *(v.t.)* (Bio)	SG028
shed[2] *(v.t.)* (Bio)	SG063
sheet erosion *(n.)*	FH073
shell[1] *(n.)* (Bio)	CF061
shell[2] *(n.)* (Ch)	DB009
shell[3] *(n.)* (Bio)	SH084
shell membrane *(n.)*	SH085
sherardize *(v.t.)*	BB118
S.H.F. *(abbr.)*	NC031
shift[1] *(v.t.)* (Bio, Ch, Ph)	AF025
shift[2] *(v.i.)* (Bio, Ch, Ph)	AF055
shifting cultivation *(n.)*	GB006
shin *(n.)*	CJ075
S.H.M. *(abbr.)*	NB098
shock *(n.)*	AG098
shoot *(n.)*	CH071
short *(v.t.)*	NJ086
short circuit[1] *(n.)* (Ph)	NJ061
short circuit[2] *(v.t.)* (Ph)	NJ085
shorten *(v.t.)*	AG035
short sight *(n.)*	HC080
shoulder-blade *(n.)*	CK153
shoulder girdle *(n.)*	CK146
shower *(n.)*	NC046
shrink *(v.)*	AG043
shrinkable *(adj.)*	AG048
shrub *(n.)*	CE002
shunt[1] *(v.t.)* (Bio, Ch, Ph)	AF010
shunt[2] *(n.)* (Ph)	NJ034
shunt-wound *(adj.)*	NK097
sibling *(n.)*	SJ024
sickness *(n.)*	JC004
sideways on *(adv.)*	AG112
siemens *(n.)*	KG032
sieve-plate *(n.)*	PB024
sieve-tube *(n.)*	PB022
sight *(n.)*	HC001
sigma bond *(n.)*	DA028
sigmoid *(adj.)*	CG124
sigmoid notch *(n.)*	CK097
sign *(n.)*	JC125
signal *(n.)*	NM117
significant *(adj.)*	AN057
significant figures *(n.pl.)*	AN005
silica *(n.)*	FH040
silicates *(n.pl.)*	FH041
siliceous *(adj.)*	CN027
silicon controlled rectifier *(n.)*	NM091
silicula *(n.)*	CE159
siliqua *(n.)*	CE160
silt *(n.)*	FH030
similar *(adj.)*	AP033
simple *(adj.)*	AJ033
simple epithelium *(n.)*	CM003
simple fruit *(n.)*	CE149
simple harmonic motion *(n.)*	NB096
simple leaf *(n.)*	CE099
simple pendulum *(n.)*	NB115
simple reflex *(n.)*	HB155
simultaneous *(adj.)*	AH043
single *(adj.)*	AA051
single acting *(adj.)*	NA064
single bond *(n.)*	BD056
sinuate *(adj.)*	CE096
sinus *(n.)*	CG196
sinusitis *(n.)*	HE021
sinusoid *(n.)*	PA008
sinusoidal *(adj.)*	NB028
sinus venosus *(n.)*	PA049
siphon[1] *(n.)* (Ph)	KF032
siphon[2] *(n.)* (Bio)	MJ059
Siphonaptera *(n.pl.)*	CC078
Siphonophora *(n.pl.)*	CC011
siphonostele *(n.)*	CH053
Siphunculata *(n.pl.)*	CC084
Sirenia *(n.pl.)*	CC204
site[1] *(n.)* (Bio, Ch, Ph)	AA047
site[2] *(v.t.)* (Bio, Ch, Ph)	AA050
situation *(n.)*	AA045
SI units *(n.pl.)*	KG014
skeletal *(adj.)*	CK008
skeletal muscle *(n.)*	CP033
skeletogenous *(adj.)*	CK009
skeleton *(n.)*	CK001
sketch *(n.)*	AQ029
sketchy *(adj.)*	AQ037
skew *(adj.)*	AF090
skin *(n.)*	CF001

skip distance *(n.)* NC025
skotophile *(n.)* FD063
skull *(n.)* CK056
sky wave *(n.)* NC011
slag *(n.)* BB091
slender *(adj.)* CG092
slice *(v.t.)* AG075
slide *(v.)* FC053
sliding friction *(n.)* EC052
slight *(adj.)* AG110
slime fungi *(n.pl.)* CB012
slime mould *(n.)* CB013
slip *(n.)* FB041
slip plane *(n.)* BG008
slip-rings *(n.pl.)* NK092
slit[1] *(v.t.)* (Bio, Ch, Ph) AG069
slit[2] *(n.)* (Bio) CG295
slough[1] *(v.)* (Bio) CF037
slough[2] *(v.)* (Bio) SG030
slow *(adj.)* AH031
small intestine *(n.)* MF030
smell *(n.)* HE001
smelting *(n.)* BB088
smoke *(n.)* DE012
smoothing *(adj.)* NK127
smoothing circuit *(n.)* NL050
smooth muscle *(n.)* CP051
smoulder *(v.i.)* KA060
snap[1] *(v.)* (Bio, Ch, Ph) AG095
snap[2] *(v.)* (Ph) KE025
Snell's law *(n.)* ND041
snout *(n.)* HE014
Sn^1 reaction *(n.)* KA011
Sn^2 reaction *(n.)* KA012
soap[1] *(n.)* (Ch) DE007
soap[2] *(n.)* (Ch) BF008
soar *(v.i.)* FC052
social *(adj.)* GA047
social releaser *(n.)* HB167
society[1] *(n.)* (Bio) GA036
society[2] *(n.)* (Bio) GA131
socket *(n.)* ME022
sodium vapour lamp *(n.)* NE018
soft[1] *(adj.)* (Ph) NH074
soft[2] *(n.)* (Ph) QB026
soft palate *(n.)* ME030
soft water *(n.)* DD024
soil *(n.)* FH022
soil atmosphere *(n.)* FH054
soil conservation *(n.)* GB010
soil granulation *(n.)* FH056
soil pH *(n.)* FH055
soil profile *(n.)* FH047
soil solution *(n.)* FH060
sol *(n.)* DE020
solar *(adj.)* EC034
solar plexus *(n.)* HB056
solar system *(n.)* EC027
sole[1] *(adj.)* (Bio, Ch, Ph) AA052
sole[2] *(n.)* (Bio) CJ078
solenocyte *(n.)* FF004
solenoid *(n.)* NK024
solenostele *(n.)* CH056
solid[1] *(n.)* (Bio, Ch, Ph) AB005
solid[2] *(n.)* (Ch) BC002
solidify[1] *(v.t.)* (Ch) EE051
solidify[2] *(v.i.)* (Ch) EE052
solid-state component *(n.)* NJ060
solitary *(adj.)* AA053
solubility product *(n.)* KB010
soluble *(n.)* DD029
solute *(n.)* DD006
solution *(n.)* DD001
solution polymerization *(n.)* BH004
solvated *(adj.)* DD054
solvation *(n.)* DD050
solvation energy *(n.)* DA020
Solvay process *(n.)* BB104
solvent *(n.)* DD002
solvent front *(n.)* EF007
som AL176
soma *(n.)* CJ046
somatic *(adj.)* CJ062
somatic peripheral nervous system *(n.)* HB007
somatotropic hormone *(n.)* JA017
somatotype *(n.)* CJ051
somersault *(v.i.)* FC040
something *(n.)* AN046
somites *(n.pl.)* SH070
somitic mesoderm *(n.)* SH069
sonic *(adj.)* NH036
sonic boom *(n.)* NH011
sonic depthfinder *(n.)* NH025
sonometer *(n.)* NH066
sorbent *(n.)* BF006
s-orbital *(n.)* DB013
soredium *(n.)* SC035
sorosis *(n.)* CE189
sorus *(n.)* SF195
sound[1] *(adj.)* (Bio) JC103
sound[2] *(n.)* (Ph) NH001
soundboard *(n.)* NH034
sound waves *(n.pl.)* NH002
source[1] *(n.)* (Bio, Ch, Ph) AH012
source[2] *(n.)* (Ph) ND001
sow *(v.t.)* GB054
space[1] *(n.)* (Bio, Ch, Ph) AA001
space[2] *(v.t.)* (Bio, Ch, Ph) AA026
space capsule *(n.)* EC008
space-charge *(n.)* NL004
space-charge limited *(adj.)* NL037
spacecraft *(n.)* EC006
space probe *(n.)* EC005
spaceship *(n.)* EC007
space-time *(n.)* EC042
spadix *(n.)* SF095
sparing *(adj.)* AN144
spark *(v.i.)* NE027
spark discharge *(n.)* NE002
sparking potential *(n.)* NE003
sparse *(adj.)* AN147
spasm *(n.)* CP026
spathe *(n.)* SF074
spatial *(adj.)* AA038
spatulate *(adj.)* CE107
spawn[1] *(n.)* (Bio) SG061
spawn[2] *(v.)* (Bio) SG062
spay *(v.t.)* SB060
special *(adj.)* AM032
specialization[1] *(n.)* (Bio) CT008
specialization[2] *(n.)* (Bio) GA093
special theory of relativity *(n.)* EC036
species[1] *(n.)* (Bio) CA004
species[2] *(n.)* (Ch) BC048
specific[1] *(adj.)* (Bio, Ch, Ph) AN056
specific[2] *(adj.)* (Bio, Ch, Ph) AN063

specific[3] *(adj.)* (Bio) CA033
specific conductance *(n.)* NJ045
specific conductivity *(n.)* EG003
specific gravity *(n.)* BA028
specific heat *(n.)* LB031
specific heat capacity *(n.)* LB030
specific heat capacity of a gas *(n.)* LD016
specific inductive capacity *(n.)* •QC035
specificity *(n.)* MA027
specific latent heat *(n.)* LB035
specific resistance *(n.)* NJ039
specific rotary power *(n.)* NB083
specific rotation *(n.)* NB077
specified *(adj.)* AN060
specimen *(n.)* AP045
spectacles *(n.pl.)* ND085
spectrometer *(n.)* ND112
spectroscope *(n.)* ND114
spectrum *(n.)* ND095
specular *(adj.)* ND037
specular reflection *(n.)* NB027
speculate *(v.i.)* AM018
speed *(n.)* EA020
speed of sound *(n.)* NH005
spent *(adj.)* BB100
sperm *(n.)* SB105
spermagonium *(n.)* SB148
spermaphyte *(n.)* SD009
spermatheca *(n.)* SE008
spermatic cord *(n.)* SE025
spermatid *(n.)* SB107
spermatium *(n.)* SB147
spermatocyte *(n.)* SB106
spermatogenesis *(n.)* SB112
spermatogonium *(n.)* SB108
spermatophore *(n.)* SB111
Spermatophyta *(n.pl.)* CB004
spermatophyte *(n.)* SD008
spermatozoid *(n.)* SB146
spermatozoon *(n.)* SB104
Sphenopsida *(n.pl.)* CB010
sphere *(n.)* CG101
spherical *(adj.)* CG135
sphincter *(n.)* FB074
spiculate *(adj.)* CK227
spicule *(n.)* CK224
spike *(n.)* SF094
spikelet *(n.)* SF076
spin *(v.)* AF042
spina bifida *(n.)* CK024
spinal accessory nerve *(n.)* HB045
spinal canal *(n.)* HB101
spinal cord *(n.)* HB092
spinal nerve *(n.)* HB024
spindle *(n.)* CU045
spindle attachment *(n.)* CU049
spindle-shaped *(adj.)* CG141
spine[1] *(n.)* (Bio) CG309
spine[2] *(n.)* (Bio) CK013
spine[3] *(n.)* (Bio) CD002
spine[4] *(n.)* (Bio) CE025
spine[5] *(n.)* (Bio) CE075
spinneret *(n.)* CF123
spinning gland *(n.)* CF122
spin quantum number *(n.)* NC077
spinthariscope *(n.)* NF029
spinule *(n.)* CE026
spiny *(adj.)* CE094
spiracle *(n.)* MJ064
spiracular *(adj.)* MJ066
spiraculate *(adj.)* MJ067
spiral *(n.)* CG103
spiral cleavage *(n.)* SH009
spiral lamina *(n.)* HD067
spiral phyllotaxis *(n.)* CE052
spiral thickening *(n.)* PB031
spiral valve *(n.)* MF037
spirillum *(n.)* JC065
spirochaete *(n.)* JC066
spit *(v.)* MJ106
splanchnic *(adj.)* CJ045
splanchnocranium *(n.)* CK060
splanchnology *(n.)* CG332
spleen *(n.)* PA088
sponge *(n.)* CC005
spongin *(n.)* CN018
spongocoel *(n.)* CJ004
spongy bone *(n.)* CN047
spongy mesophyll *(n.)* CS062
spontaneous *(adj.)* FD075
sporadic *(adj.)* JC056
sporangia *(n.pl.)* SC036
sporangiophore *(n.)* SC043
sporangiospore *(n.)* SC017
sporangium *(n.)* SC029
spore *(n.)* SC012
spore case *(n.)* SC022
spore mother cell *(n.)* SC016
sporiferous *(adj.)* SC037
sporiparous *(adj.)* SC039
sporoblast *(n.)* SC014
sporocyst *(n.)* SD032
sporocyte *(n.)* SC015
sporogenesis *(n.)* SC002
sporogony *(n.)* SC003
sporoid *(adj.)* SC038
sporont *(n.)* SD038
sporophore *(n.)* SC042
sporophyll *(n.)* SC048
sporophyte *(n.)* SD002
Sporozoa *(n.pl.)* CA069
sporozoid *(n.)* SC021
sporozoite *(n.)* SD033
sport *(n.)* TA019
sporulation *(n.)* SC004
spread[1] *(n.)* (Bio, Ch, Ph) AA017
spread[2] *(v.)* (Bio, Ch, Ph) AG088
spring *(v.i.)* FC038
spring balance *(n.)* EB065
sprout[1] *(n.)* (Bio) CH074
sprout[2] *(v.i.)* (Bio) FA033
spur[1] *(n.)* (Bio) CD003
spur[2] *(n.)* (Bio) SF044
spurt *(v.i.)* AF109
squama *(n.)* CF007
Squamata *(n.pl.)* CC159
squamiferous *(adj.)* CF023
squamose *(adj.)* CF022
squamous[1] *(adj.)* (Bio) CM016
squamous[2] *(adj.)* (Bio) CF021
squamous epithelium *(n.)* CM012
squat[1] *(adj.)* (Bio) CG091
squat[2] *(v.i.)* (Bio) FB017
squirrel-cage *(n.)* NK060
squirt *(v.t.)* AF115
stability *(n.)* KD005
stabilization[1] *(n.)* (Ph) KD008
stabilization[2] *(n.)* (Ph) NM121

stabilize[1] *(v.t.)* (Ch) KA038
stabilize[2] *(v.t.)* (Ch) DE013
stabilize[3] *(v.)* (Ph) KD014
stabilizer *(n.)* KD007
stable[1] (stabile) *(adj.)* (Ch) KA043
stable[2] *(adj.)* (Ph) KD015
stable equilibrium *(n.)* KD002
stable octet *(n.)* DA023
stage *(n.)* AH032
stale *(adj.)* MJ107
stalk *(n.)* CH008
stamen *(n.)* SF154
staminal *(adj.)* SF165
staminate *(adj.)* SD090
staminiferous *(adj.)* SF166
staminode *(n.)* SF162
standard[1] *(n.)* (Bio, Ch, Ph) AN071
standard[2] *(adj.)* (Bio, Ch, Ph) AN094
standard[3] *(n.)* (Bio) SF042
standard electrode potential *(n.)* EG051
standardize *(v.t.)* AN082
standard mass *(n.)* EB052
standard resistor *(n.)* NJ030
standard solution *(n.)* DD012
stand for *(v.t.)* AK035
standing crop *(n.)* GA020
standing wave *(n.)* NB038
stapes *(n.)* HD035
staphylococcus *(n.)* JC062
staple *(adj.)* MH026
starch *(n.)* MD031
start *(v.)* AD022
starve *(v.)* MH022
-stasis *(suff.)* AL132
state[1] *(v.t.)* (Bio, Ch, Ph) AM022
state[2] *(n.)* (Ch) LD019
state function *(n.)* LD021
statement *(n.)* AM001
state of affairs *(n.)* AK019
state of division *(n.)* BC006
states of matter *(n.pl.)* BC001
static[1] *(adj.)* (Ph) EB040
static[2] *(n.)* (Ph) NM023
static friction *(n.)* EC049
statics *(n.sing.)* KD013
stationary *(adj.)* AF013
stationary phase *(n.)* EF005
stationary wave *(n.)* NB035
statocyst *(n.)* HD005
statolith *(n.)* HD008
stator *(n.)* NA054
steady *(adj.)* AN091
steam distillation *(n.)* BB022
steam point *(n.)* LA013
steapsin *(n.)* MA086
steelyard *(n.)* EB063
steer *(v.)* FC048
Stefan's law *(n.)* LB022
stele *(n.)* CH048
stem *(n.)* CH066
stemma *(n.)* HC016
stenohaline *(adj.)* FH020
stenohygric *(adj.)* GA173
stenosed *(adj.)* CG221
stenothermous *(adj.)* GA053
step-down *(adj.)* NK081
step-up *(adj.)* NK080
steradian *(n.)* KG023
stereid *(n.)* CS074
stereokinesis *(n.)* FD048
stereoscopic vision *(n.)* HC009
stereotaxis *(n.)* FD021
stereotropism *(n.)* FD036
sterile *(adj.)* SB070
sterilize *(v.t.)* SB059
sterility *(n.)* SB057
sternebra *(n.)* CK154
sternite *(n.)* CK198
sternum[1] *(n.)* (Bio) CK155
sternum[2] *(n.)* (Bio) CK197
steroid *(n.)* MD027
sterol *(n.)* MD028
STH *(abbr.)* JA023
stigma[1] *(n.)* (Bio) SF124
stigma[2] *(n.)* (Bio) MJ065
stilt roots *(n.pl.)* CH101
stimulant *(n.)* HA006
stimulate *(v.t.)* HA011
stimulated *(adj.)* HA015
stimulation *(n.)* HA004
stimulative *(adj.)* HA017
stimulus *(n.)* HA002
sting[1] *(n.)* (Bio) CD004
sting[2] *(v.)* (Bio) CD006
stinging hairs *(n.pl.)* CE032
stipe[1] *(n.)* (Bio) CH009
stipe[2] *(n.)* (Bio) SF189
stipule *(n.)* CE073
stir *(v.t.)* AG103
stirrup *(n.)* HD037
stock[1] *(n.)* (Bio) GB070
stock[2] *(n.)* (Bio) GB028
stoichiometric *(adj.)* NN009
stoichiometric compound *(n.)* NN003
stoichiometry *(n.)* NN002
Stoke's law *(n.)* EC076
stolon *(n.)* SC070
stom AL178
stoma[1] *(n.)* (Bio) MJ035
stoma[2] *(n.)* (Bio) CE070
stomach *(n.)* MF010
stomatal[1] *(adj.)* (Bio) MJ037
stomatal[2] *(adj.)* (Bio) CE077
stomate[1] *(adj.)* (Bio) MJ038
stomate[2] *(adj.)* (Bio) CE078
stomium *(n.)* ME004
stomodaeum *(n.)* ME002
stone *(n.)* CE143
stone cell *(n.)* CS070
stop *(v.)* AD026
stop watch *(n.)* KG004
stout *(adj.)* CG093
stout-walled *(adj.)* BB066
straight chain *(n.)* BD065
straightforward *(adj.)* AJ037
strain *(n.)* KE003
strand *(n.)* TB019
stratified[1] *(adj.)* (Bio) CM017
stratified[2] *(adj.)* (Bio) CG182
stratified epithelium *(n.)* CM004
stratum[1] *(n.)* (Ch) AC057
stratum[2] *(n.)* (Bio, Ch, Ph) CG172
stratum corneum *(n.)* CF028
stratum Malpighii *(n.)* CF027
straw *(n.)* GB027
streamline *(v.t.)* EC090
streamlined *(adj.)* FC055
streamline flow *(n.)* FC070

streptococcus *(n.)* JC061
stress *(n.)* KE002
stretch *(v.t.)* KE023
striated muscle *(n.)* CP032
stridulation *(n.)* MJ110
strike *(v.t.)* AG106
striking potential *(n.)* NE020
string *(n.)* NH089
stringed instruments *(n.pl.)* NH077
strip *(n.)* CG156
strip cropping *(n.)* GB014
striped muscle *(n.)* CP031
strobila *(n.)* CK222
strobilation *(n.)* FA015
strobilus *(n.)* SD006
stroboscope *(n.)* KG008
stroke *(n.)* NA044
stroma *(n.)* CT072
strong electrolyte *(n.)* EG022
struck *(adj.)* NH112
structural formula *(n.)* BE010
structural gene *(n.)* TC018
structure[1] *(n.)* (Bio, Ch, Ph) AC010
structure[2] *(n.)* (Bio) CG057
structure of the molecule *(n.)* DC001
strut *(n.)* KD029
study[1] *(n.)* (Bio, Ch, Ph) AM002
study[2] *(v.t.)* (Bio, Ch, Ph) AM016
stunted *(adj.)* FA039
style[1] *(n.)* (Bio) SF125
style[2] *(n.)* (Bio) CF120
stylet *(n.)* ME130
styloid *(adj.)* SF142
sub- *(pre.)* AL008
subclavian *(adj.)* CK164
subclavian artery *(n.)* PA069
subclinical *(adj.)* JC169
subcutaneous *(adj.)* CG021
subdermal *(adj.)* CG022
suberin *(n.)* CS005
suberization *(n.)* CS022
subgerminal cavity *(n.)* SH033
subjective *(adj.)* AM059
sublimation *(n.)* BB016
sublime *(v.)* BB047
subliminal stimulus *(n.)* HA008
subnormal *(adj.)* AN097
subsoil *(n.)* FH049
substance *(n.)* AB003
substitute *(v.)* AF030
substitution *(n.)* KA009
substrate *(n.)* MA022
subtended angle *(n.)* ND010
subterranean *(adj.)* CH020
subtractive colours *(n.pl.)* ND093
succeeding *(adj.)* AH037
succession *(n.)* GA127
successive *(adj.)* AH036
succulent *(adj.)* CE037
succus entericus *(n.)* MG023
sucker[1] *(n.)* (Bio) SC069
sucker[2] *(n.)* (Bio) CG188
sucrase *(n.)* MA065
sucrose *(n.)* MD046
suction *(n.)* KF013
Suctoria *(n.pl.)* CA066
sudden *(adj.)* AH022
sufficient *(adj.)* AN136
suffix *(n.)* AL003
suffocate *(v.)* MJ024
sugar *(n.)* MD032
sugars *(n.pl.)* BD100
sulci *(n.pl.)* HB149
sulcus *(n.)* CG317
sulphate *(n.)* BD029
sulphide *(n.)* BD028
sulphite *(n.)* BD030
sulphonation *(n.)* KA018
sum *(n.)* AN001
summary *(n.)* AQ032
summation *(n.)* HA024
summation tone *(n.)* NH064
sunspot *(n.)* QB046
super- *(pre.)* AL010
superconductivity *(n.)* NJ042
superconductor *(n.)* NJ044
superficial *(adj.)* CG241
superheated[1] *(adj.)* (Bio, Ch, Ph) AD069
superheated[2] *(adj.)* (Ph) NA063
superheterodyne *(n.)* NM046
super high frequency *(n.)* NC030
superior *(adj.)* CG003
superior gynoecium *(n.)* SF127
superior ovary *(n.)* SF121
supernatant liquid *(n.)* BB014
superpose *(v.t.)* NB050
superposition image *(n.)* HC034
supersonic *(adj.)* NH038
supinate *(adj.)* CK092
supination *(n.)* CK082
supinator *(n.)* CK084
supine *(adj.)* CK090
supplemental air *(n.)* MJ099
suppress[1] *(v.t.)* (Bio, Ch, Ph) AK028
suppress[2] *(v.t.)* (Bio) JC167
suppressive *(adj.)* JC170
suppressor grid *(n.)* NL019
suppuration *(n.)* JC090
supra- *(pre.)* AL009
suprarenal gland *(n.)* JA007
suprascapula *(n.)* CK152
surface[1] *(n.)* (Bio, Ch, Ph) AA020
surface[2] *(n.)* (Bio) CG234
surface[3] *(adj.)* (Bio) CG242
surface-acting agent *(n.)* BF007
surface energy *(n.)* ED031
surface phenomena *(n.pl.)* BF001
surface tension *(n.)* ED028
surface water *(n.)* FH071
surgeon *(n.)* JC140
surgery *(n.)* JC147
surroundings *(n.pl.)* AA041
survival[1] *(n.)* (Bio, Ch, Ph) AD039
survival[2] *(n.)* (Bio) FA004
survive *(v.i.)* AD046
survivor *(n.)* AD038
suspensoid *(n.)* DE021
suspension *(n.)* DD042
suspension polymerization *(n.)* BH005
suspensory ligament *(n.)* HC075
sustenance *(n.)* MB005
suture *(n.)* CG321
swallow *(v.)* ME143
swarm *(n.)* GA083
sweat *(n.)* FE025
sweat gland *(n.)* FE027
sweat pore *(n.)* FE028
sweep[1] *(n.)* (Bio, Ch, Ph) AA018

sweep[2] *(v.)* (Bio, Ch, Ph) AG052
sweetbread *(n.)* MA122
swell *(v.i.)* AG022
swim *(v.i.)* FC047
swim bladder *(n.)* MJ060
swimmeret *(n.)* CF121
switch *(n.)* NJ062
switch off *(v.t.)* NJ083
switch on *(v.t.)* NJ082
syconium *(n.)* CE191
syconus *(n.)* CE188
sym- *(pre.)* AL030
symbiont *(n.)* GA114
symbiosis *(n.)* GA113
symbol *(n.)* AN070
symmetrical *(adj.)* CG054
symmetry *(n.)* CG030
sympathetic ganglion *(n.)* HB052
sympathetic nervous system *(n.)* HB010
sympathetic trunk *(n.)* HB053
sympatric *(adj.)* GA177
Sympetalae *(n.pl.)* CB111
sympetalous *(adj.)* SF063
symphile *(n.)* GA038
symphysis *(n.)* CG322
sympodial *(adj.)* CH016
sympodium *(n.)* CH007
symptom *(n.)* JC108
symptomatic *(adj.)* JC136
syn- *(pre.)* AL030
synapse *(n.)* CQ049
synapsid *(adj.)* CC172
synapsis *(n.)* CU055
synaptic *(adj.)* CQ056
syncarpous *(adj.)* SF141
synchrocyclotron *(n.)* NE050
synchronize *(v.t.)* KG009
synchronized *(adj.)* KG012
synchronizer *(n.)* KG007
synchronous *(adj.)* KG011
synchrotron *(n.)* NE052
synchrotron radiation *(n.)* NC063
synctium *(n.)* CL003
syndactyly *(n.)* FC031
synecology *(n.)* GA006
synergetic *(adj.)* FG038
synergic *(adj.)* FG036
synergid *(n.)* SD074
synergism *(n.)* FG002
synergist *(n.)* FB044
syngametic *(adj.)* SB039
syngamy *(n.)* SA023
syngenesis *(n.)* SB024
synoecious *(adj.)* SD092
synovia *(n.)* CK128
synovial capsule *(n.)* CK130
synovial fluid *(n.)* CK129
synovial membrane *(n.)* CK131
synovial sac *(n.)* CK132
synsepalous *(adj.)* SF067
synthesis *(n.)* BB027
synthesis gas *(n.)* BB114
synthetic *(adj.)* KA046
syringograde *(adj.)* FC027
syrinx *(n.)* MJ111
system[1] *(n.)* (Bio, Ch, Ph) AC012
system[2] *(n.)* (Ch) LD013
system[3] *(n.)* (Bio) CG342
system[4] *(n.)* (Bio) CJ032
systematic *(adj.)* BC062
systematics *(n.sing.)* CA017
systemic *(adj.)* CG346
systemic arch *(n.)* PA020
systemic circulation *(n.)* PA036
systemic heart *(n.)* PA043
systems in vibration *(n.pl.)* NH003
systole *(n.)* PA059

tabulate *(v.t.)* AN115
tactic *(adj.)* FD022
tactile *(adj.)* HB168
tactile corpuscle *(n.)* HE023
tadpole *(n.)* SD050
tagma *(n.)* CK185
tail *(n.)* FB037
taken too far *(adj.)* AM088
take in *(v.t.)* AF126
take place *(v.i.)* AD006
take up[1] *(v.t.)* (Bio) FE017
take up[2] *(v.t.)* (Bio) FH018
talon *(n.)* CF015
talus *(n.)* CK116
tangential plane *(n.)* CG041
taper *(v.i.)* CG079
tapeworm *(n.)* CC024
tapped *(adj.)* NK082
tapping key *(n.)* NJ063
tap root *(n.)* CH105
target[1] *(n.)* (Bio, Ch, Ph) AF084
target[2] *(n.)* (Ph) NE055
tarnish[1] *(n.)* (Ch) BF013
tarnish[2] *(v.)* (Ch) BF016
tarsal bones *(n.pl.)* CK113
tarsals *(n.pl.)* CK112
tarsus[1] *(n.)* (Bio) CK111
tarsus[2] *(n.)* (Bio) CK204
tartar *(n.)* ME093
tassel *(n.)* SF159
taste *(n.)* ME035
taste bud *(n.)* ME036
taxis *(n.)* FD002
taxon *(n.)* CA002
taxonomy *(n.)* CA001
tear *(n.)* HC063
tear gland *(n.)* HC065
teat *(n.)* SE051
technical *(adj.)* BB099
technique *(n.)* AQ018
tegmen *(n.)* SD100
tele- *(pre.)* AL025
telegraph *(n.)* NK028
telencephalon *(n.)* HB070
teleneurite *(n.)* CQ015
Teleostei *(n.pl.)* CC152
Teleostomi *(n.pl.)* CC151
telephone *(n.)* NK033
telephone receiver *(n.)* NK034
telescope *(n.)* ND075
television *(n.)* NE041
television receiver *(n.)* NE042
telodendrion *(n.)* CQ016
telolecithal *(adj.)* SH105
telophase *(n.)* CU053
telotaxis *(n.)* FD013
temperament *(n.)* NH106
temperature *(n.)* LA001
temperature recorder *(n.)* LA040
temperature scale *(n.)* LA003

template *(n.)* TB018
temporary *(adj.)* AH016
temporary depression of zero *(n.)* LA032
tend *(v.i.)* AF063
tendon *(n.)* CP043
tendril *(n.)* CE074
tendrillar *(adj.)* CE080
tendrillous *(adj.)* CE079
tense *(adj.)* EB041
tension[1] *(n.)* (Ph) EB004
tension[2] *(n.)* (Bio) FG012
tentacle *(n.)* CF115
Tentaculata *(n.pl.)* CC017
tentaculum *(n.)* CF116
tentative *(adj.)* AM087
tepal *(n.)* SF037
ter- *(pre.)* AL053
tergite *(n.)* CK196
tergum *(n.)* CK195
term *(n.)* AK015
terminal[1] *(adj.)* (Bio) CG017
terminal[2] *(n.)* (Ph) NJ046
terminal velocity *(n.)* EC077
terminate *(v.t.)* AD030
terpene *(n.)* MD024
terracing *(n.)* GB013
terrestrial[1] *(adj.)* (Ph) EB073
terrestrial[2] *(adj.)* (Bio) GA062
terrestrial magnetism *(n.)* QB031
terrestrial telescope *(n.)* ND077
terricolous *(adj.)* GA063
territory *(n.)* GA028
tertiary productivity *(n.)* GA019
tesla *(n.)* KG035
test[1] *(n.)* (Bio, Ch, Ph) AP041
test[2] *(v.t.)* (Bio, Ch, Ph) AP048
testa *(n.)* SD099
testicle *(n.)* SB113
testicular *(adj.)* SB114
testis *(n.)* SB103
testosterone *(n.)* JA052
tetanus *(n.)* CP027
tetany *(n.)* JC118
tetra- *(pre.)* AL045
tetradynamous *(adj.)* SF180
tetrahedral *(adj.)* DC007
tetrapod *(n.)* CK007
Tetrapoda *(n.pl.)* CC135
tetrode *(n.)* NL011
tetrode transistor *(n.)* NM104
TH *(abbr.)* JA046
thalamencephalon *(n.)* HB132
thalamus[1] *(n.)* (Bio) HB119
thalamus[2] *(n.)* (Bio) SF013
thalline *(adj.)* CH044
thalloid *(adj.)* CH045
Thallophyta *(n.pl.)* CB002
thallophyte *(n.)* CH002
thallose *(adj.)* CH046
thallus *(n.)* CH036
theca AL151
thecodont *(adj.)* ME107
Theopsida[1] *(n.pl.)* (Bio) CC169
Theopsida[2] *(n.pl.)* (Bio) CC188
theoretical concept *(n.)* AK014
theoretical terms *(n.pl.)* AK018
theory *(n.)* AM070
therapeutic *(adj.)* JC171
Therapsida *(n.pl.)* CC168
Theria *(n.pl.)* CC185
therm- *(pre.)* AL109
thermal absorber *(n.)* LB017
thermal absorption *(n.)* LB015
thermal conduction *(n.)* LB001
thermal conductivity *(n.)* LB005
thermal conductor *(n.)* LB002
thermal decomposition *(n.)* KA028
thermal dissociation *(n.)* KA031
thermal efficiency *(n.)* NA036
thermal emission *(n.)* LB016
thermal emitter *(n.)* LB018
thermal expansion *(n.)* LA045
thermal insulator *(n.)* LB003
thermal runaway *(n.)* NM122
thermion *(n.)* NL006
thermionic effect *(n.)* NL002
thermionic emission *(n.)* NL003
thermionic tube *(n.)* NL014
thermionic valve *(n.)* NL007
thermistor *(n.)* NM088
thermo- *(pre.)* AL109
thermochemical equation *(n.)* LD007
thermochemistry *(n.)* LD001
thermocouple *(n.)* NJ108
thermodynamics *(n.sing.)* LD012
thermodynamic scale *(n.)* LA009
thermoelectric effects *(n.pl.)* NJ103
thermoelectric e.m.f. *(n.)* NJ106
thermoelectricity *(n.)* NJ101
thermoelectric series *(n.)* NJ107
thermoelectric thermometer *(n.)* LA037
thermokinesis *(n.)* FD046
thermometric liquid *(n.)* LA019
thermometry *(n.)* LA020
thermonasty *(n.)* FD055
thermophil *(adj.)* FD070
thermophile *(n.)* FD066
thermophilic[1] *(adj.)* (Bio) CA081
thermophilic[2] *(adj.)* (Bio) FD069
thermopile[1] *(n.)* (Ph) LB019
thermopile[2] *(n.)* (Ph) NJ109
thermoplastic *(n.)* BH019
thermosetting plastic *(n.)* BH020
thermostable *(adj.)* KA044
thermostat *(n.)* LA038
thermotaxis *(n.)* FD007
thermotropism *(n.)* FD030
Theropsida *(n.pl.)* CC170
thesocyte *(n.)* CU074
thiamin *(n.)* MH061
thigh *(n.)* CJ073
thigmokinesis *(n.)* FD047
thigmonasty *(n.)* FD056
thigmotaxis *(n.)* FD008
thigmotropism *(n.)* FD031
thin film *(n.)* NB041
thin-layer chromatography *(n.)* EF011
thin-walled *(adj.)* BB067
thiosulphate *(n.)* BD031
third *(n.)* NH110
thixotropy *(n.)* EC079
Thomson effect *(n.)* NJ111
thorax[1] *(n.)* (Bio) CJ034
thorax[2] *(n.)* (Bio) CK186
thorium series *(n.)* NF023
thorn *(n.)* CE024

thread *(n.)* NA022
thread-cell *(n.)* CU080
threadworm *(n.)* CC035
three-phase *(adj.)* NK125
three-pin plug *(n.)* NK119
threshold frequency *(n.)* NL077
threshold level *(n.)* NL078
threshold of audibility *(n.)* NH059
threshold stimulus *(n.)* HA009
thrive *(v.i.)* FG031
throb *(v.i.)* AG056
thrombin *(n.)* CR065
thrombocyte *(n.)* CR060
thrombogen *(n.)* CR068
thrombokinase *(n.)* CR062
thrombokinesis *(n.)* CR073
thromboplastin *(n.)* CR063
thrombosis *(n.)* CR080
thrombus *(n.)* CR070
thrum-eyed *(adj.)* SF170
thrust *(n.)* EB005
thumb *(n.)* CJ071
thylakoid *(n.)* CT074
thymus *(n.)* PA089
thyratron *(n.)* NL036
thyristor *(n.)* NM089
thyroglobulin *(n.)* JA019
thyroid gland *(n.)* JA004
thyrotropic hormone *(n.)* JA041
thyroxin *(n.)* JA018
tibia[1] *(n.)* (Bio) CK108
tibia[2] *(n.)* (Bio) CK203
tidal air *(n.)* MJ097
tie *(n.)* KD030
till *(v.t.)* GB053
tilt *(v.)* EB071
tilted *(adj.)* AF094
timbre *(n.)* NH056
time[1] *(n.)* (Bio, Ch, Ph) AH001
time[2] *(v.t.)* (Bio, Ch, Ph) KG010
time constant *(n.)* NL049
tin *(v.t.)* BB119
tinning *(n.)* BB115
tint *(n.)* ND107
tip *(n.)* CG072
tissue *(n.)* CL001
tissue culture *(n.)* CL011
tissue fluid *(n.)* CR007
tissue regeneration *(n.)* FA010
tissue respiration *(n.)* MJ011
titration *(n.)* BB036
titration value *(n.)* BB037
titre *(n.)* BB038
toadstool *(n.)* SC047
tocopherols *(n.pl.)* MH046
toe *(n.)* CJ079
tolerable *(adj.)* FG041
tolerance *(n.)* FG013
tolerate *(v.t.)* FG030
tomentose *(adj.)* CE069
tone[1] *(n.)* (Ph) NH097
tone[2] *(n.)* (Ph) NH052
tone[3] *(n.)* (Ph) NH104
tongue *(n.)* ME033
tonic *(n.)* NH107
tonnage oxygen *(n.)* BB111
tonoplast *(n.)* CT040
tonsilitis *(n.)* ME044
tonsils *(n.)* ME031
tonus[1] *(n.)* (Bio) FE004
tonus[2] *(n.)* (Bio) CP024
tool *(n.)* AQ002
tooth[1] *(n.)* (Bio) ME058
tooth[2] *(n.)* (Bio, Ch, Ph) ME059
topotaxis *(n.)* FD012
topsoil *(n.)* FH048
torpid *(adj.)* FA047
torpor *(n.)* FA022
torque *(n.)* KD050
torsion *(n.)* KD051
torsion balance *(n.)* KD052
torsion head *(n.)* KD053
torus *(n.)* SF014
total[1] *(adj.)* (Bio, Ch, Ph) AN016
total[2] *(adj.)* (Ph) ND039
total[3] *(n.)* (Bio, Ch, Ph) AN002
total internal reflection *(n.)* ND044
touch *(n.)* HE022
tough *(adj.)* CG099
tow *(v.t.)* KD040
toxic *(adj.)* JB027
toxicity *(n.)* JB018
toxicology *(n.)* JB017
toxigenic *(adj.)* JB028
toxigenicity *(n.)* JB012
toxin *(n.)* JB011
toxoid *(n.)* JB019
trabeculae *(n.pl.)* CS075
trabecular *(adj.)* CS076
trabeculate *(adj.)* CS077
trace[1] *(n.)* (Ch) AN121
trace[2] *(adj.)* (Bio, Ch) AN149
trace elements *(n.pl.)* FH010
trachea[1] *(n.)* (Bio) MJ069
trachea[2] *(n.)* (Bio) MJ062
trachea[3] *(n.)* (Bio) PB035
tracheal gill *(n.)* MJ056
tracheal system *(n.)* MJ061
tracheid *(n.)* CS072
tracheole *(n.)* MJ063
Tracheophyta *(n.pl.)* CB006
trachoma *(n.)* HC053
track[1] *(n.)* (Bio, Ch, Ph) AA014
track[2] *(n.)* (Ph) EA012
track[3] *(v.t.)* (Bio, Ch, Ph) AA028
tract[1] *(n.)* (Bio) CG164
tract[2] *(n.)* (Bio) HB078
traditional *(adj.)* BC061
trait *(n.)* TA016
trajectory *(n.)* EC011
trans- *(pre.)* AL011
transaminase *(n.)* MA038
transamination *(n.)* MA101
trans-arrangement *(n.)* TC047
transconductance *(n.)* NL030
transcriptase *(n.)* MA050
transcription *(n.)* TB013
transduction *(n.)* TC069
transect *(n.)* GA013
transesterification *(n.)* BB126
transfer *(v.t.)* AF018
transferase *(n.)* MA033
transfer characteristics *(n.pl.)* NM108
transfer RNA *(n.)* TB009
transform *(v.t.)* AF067
transformation *(n.)* TC068
transformer *(n.)* NK070
transfusion *(n.)* JB020

transistor *(n.)* NM095
transition series *(n.)* BD042
transition temperature *(n.)* NJ043
translation *(n.)* TB014
translational *(adj.)* EA015
translocate *(v.t.)* AF020
translocation *(n.)* TC042
translucent *(adj.)* AC041
transmissibility *(n.)* JC025
transmission grating *(n.)* NB047
transmission of pathogens *(n.)* JC015
transmission of pressure *(n.)* KF009
transmission of sound *(n.)* NH004
transmit *(v.t.)* AF024
transmute *(v.t.)* AF068
transparent *(adj.)* AC039
transpiration *(n.)* FH001
transpiration pull *(n.)* FH004
transpiration stream *(n.)* FH002
transplant *(v.t.)* GB055
transport *(v.t.)* AF019
transverse *(adj.)* CG051
transverse plane *(n.)* CG040
transverse process *(n.)* CK041
transverse wave motion *(n.)* NB003
trapezius *(n.)* FB073
traumatic *(adj.)* JC107
traumatic acid *(n.)* JA087
traumatins *(n.pl.)* JA086
traumatropism *(n.)* FD032
travel *(v.t.)* AF001
treat[1] *(v.t.)* (Ch) BB080
treat[2] *(v.t.)* (Bio) JC037
tree *(n.)* CE001
trefoil *(n.)* CE123
Trematoda *(n.pl.)* CC022
tri- *(pre.)* AL044
triadelphous *(adj.)* SF178
triangle of forces *(n.)* KD009
trianthous *(adj.)* SF022
tribe *(n.)* CA013
tribology *(n.)* EC054
tribometer *(n.)* EC061
triceps *(n.)* FB071
trichogyne *(n.)* SF200
trichome *(n.)* CE030
Trichoptera *(n.pl.)* CC075
trickle *(v.i.)* AF058
tricuspid valve *(n.)* PA052
trifoliate *(adj.)* CE128
trigeminal nerve *(n.)* HB037
triggering level *(n.)* NM090
trigonal bipyramidal *(adj.)* DC011
trigonal planar *(adj.)* DC009
trigonal pyramidal *(adj.)* DC010
trimerous *(adj.)* SF026
triode *(n.)* NL010
triose *(n.)* MD040
triple bond *(n.)* BD058
triple point of water *(n.)* LA018
triplo- *(pre.)* AL063
triploblastic *(adj.)* CJ024
triploid *(adj.)* CU034
triturate *(v.t.)* AB049
trivial *(adj.)* BC058
trochanter[1] *(n.)* (Bio) CK110
trochanter[2] *(n.)* (Bio) CK201
Trochelminthes *(n.pl.)* CC042
trochlea *(n.)* CG308
trochlear nerve *(n.)* HB036
trochophore *(n.)* SG051
trochosphere *(n.)* SG052
trolley *(n.)* EB031
trophic *(adj.)* GA101
trophic level *(n.)* GA074
trophoblast *(n.)* SH042
trophotaxis *(n.)* FD017
trophotropism *(n.)* FD038
trophozoite *(n.)* SD034
tropic *(adj.)* FD040
tropism *(n.)* FD025
tropotaxis *(n.)* FD015
trough *(n.)* NB007
Trouton's rule *(n.)* LB036
true fruit *(n.)* CE182
true rib *(n.)* CK048
trunk[1] *(n.)* (Bio) CG167
trunk[2] *(n.)* (Bio) CJ065
trunk[3] *(n.)* (Bio) CH010
Trypanosoma *(n.)* CA062
trypanosome *(n.)* CA061
trypanosomiasis *(n.)* CA063
trypsin *(n.)* MA079
trypsinogen *(n.)* MA057
tube *(n.)* AC060
tube foot *(n.)* FC009
tuber *(n.)* SC066
tubercle[1] *(n.)* (Bio) CG311
tubercle[2] *(n.)* (Bio) CK054
tuberculum[1] *(n.)* (Bio) CG312
tuberculum[2] *(n.)* (Bio) CK053
tuberosity *(n.)* CG313
tubiform *(adj.)* AC074
tubing *(n.)* AC063
tubular *(adj.)* AC072
tubular gland *(n.)* CM032
tubulate *(adj.)* AC073
tubule *(n.)* AC061
Tubulidentata *(n.pl.)* CC197
tumescence *(n.)* SE031
tumour *(n.)* JC123
tundra *(n.)* GA155
tune[1] *(v.t.)* (Ph) NM036
tune[2] *(v.t.)* (Ph) NH072
tune in *(v.t.)* NM037
tunic *(n.)* CG260
tunica[1] *(n.)* (Bio) CG262
tunica[2] *(n.)* (Bio) CS043
Tunicata *(n.pl.)* CC129
tuning *(n.)* NM018
tunnel diode *(n.)* NM092
tunnel effect *(n.)* NM093
Turbellaria *(n.pl.)* CC021
turbine *(n.)* NA052
turbulence *(n.)* EC071
turbulent *(adj.)* EC093
turgescence *(n.)* CT087
turgid *(adj.)* CT094
turgidity *(n.)* CT085
turgor *(n.)* CT084
turgor pressure *(n.)* CT086
turion *(n.)* SC058
turn[1] *(v.i.)* (Bio, Ch, Ph) AF039
turn[2] *(v.i.)* (Bio, Ch, Ph) AF060
turn[3] *(n.)* (Ph) NJ053
turning force *(n.)* KD046
turnover voltage *(n.)* NM076
turns ratio *(n.)* NK073

tusk *(n.)* ME067
twine[1] *(v.i.)* (Bio) CH091
twine[2] *(v.i.)* (Bio) FA036
twist *(v.)* AF043
twitch *(n.)* CP022
two-phase *(adj.)* NK126
tympanic *(adj.)* HD040
tympanic bone *(n.)* HD027
tympanic bulla *(n.)* HD031
tympanic canal *(n.)* HD070
tympanic cavity *(n.)* HD028
tympanic membrane *(n.)* HD026
tympanoid *(adj.)* HD041
tympanum *(n.)* HD025
type *(n.)* AP046
typhlosole *(n.)* MF038

udder *(n.)* SE050
U.H.F. *(abbr.)* NC033
ulna *(n.)* CK094
ultimate[1] *(adj.)* (Bio, Ch, Ph) AC031
ultimate[2] *(adj.)* (Bio) CJ063
ultra- *(pre.)* AL026
ultra high frequency *(n.)* NC032
ultrasonic *(adj.)* NH037
ultra-violet radiation *(n.)* ND103
umbel *(n.)* SF097
umbellule *(n.)* SF104
umbilical *(adj.)* SJ036
umbilical cord *(n.)* SJ009
umbilical stalk *(n.)* SJ011
umbilical vesicle *(n.)* SJ010
umbilicus *(n.)* SJ008
umbo *(n.)* CG068
umbra *(n.)* ND004
umbrella-shaped *(adj.)* CG146
unaided *(adj.)* AG147
unaware *(adj.)* HB197
uncertainty principle *(n.)* NC083
uncombined *(adj.)* BC016
unconditioned reflex *(n.)* HB157
unconscious *(adj.)* HB194
unconsciousness *(n.)* HB185
uncontaminated *(adj.)* JD031
undamped *(adj.)* NB109
underground *(adj.)* GA055
undulate *(v.i.)* AG054
undulatory[1] *(adj.)* (Bio, Ch, Ph) AG063
undulatory[2] *(adj.)* (Bio) FC054
unfold *(v.i.)* AD042
ungulate *(n.)* CC189
unguligrade *(adj.)* FC021
unhygienic *(adj.)* JD013
uni- *(pre.)* AL051
uniaxial *(adj.)* NB085
unicell *(n.)* CA041
unicostate *(adj.)* CE088
unidentifiable *(adj.)* AP054
unification *(n.)* AA067
uniform *(adj.)* AN086
uniform velocity *(n.)* EA026
uninucleate *(adj.)* CT052
union *(n.)* AA068
uniovular *(adj.)* SJ039
unipolar *(adj.)* CQ022
unique *(adj.)* AA057
unisexual *(adj.)* SB038
unison *(n.)* NH051
unit *(n.)* AN036
unite *(v.)* AA073
univalve *(n.)* CF062
Univalvia *(n.pl.)* CC104
universal *(adj.)* AM082
universal gravitation *(n.)* EB047
unlike[1] *(adj.)* (Ph) KD044
unlike[2] *(adj.)* (Ph) QB029
unmagnetized *(adj.)* QB025
unnecessary *(adj.)* AJ072
unpolluted *(adj.)* JD030
unsaturated *(adj.)* BD098
unsaturated fatty acids *(n.pl.)* MD010
unspecified *(adj.)* AN068
unstable *(adj.)* KD016
unstable equilibrium *(n.)* KD003
unstriated muscle *(n.)* CP052
unstriped muscle *(n.)* CP050
unvarying *(adj.)* AN105
unwarranted *(adj.)* AM043
upper partials *(n.pl.)* NH048
upset *(v.t.)* FG026
upthrust *(n.)* KF016
up to date *(adj.)* AH048
uranium series *(n.)* NF022
urea *(n.)* MA093
urease *(n.)* MA041
ureotelic *(adj.)* FE022
ureter *(n.)* FF028
urethra *(n.)* FF030
uric acid *(n.)* MA094
uricotelic *(adj.)* FE023
urinary *(adj.)* FF056
urinary bladder *(n.)* FF029
urinary tract *(n.)* FF027
urination *(n.)* FF049
urine *(n.)* FF048
uriniferous *(adj.)* FF057
uriniferous tubule *(n.)* FF042
urinogenital *(adj.)* FF033
urinogenital duct *(n.)* SE002
urinogenital papilla *(n.)* SE004
urinogenital sinus *(n.)* SE003
urinogenital system *(n.)* FF026
urobilin *(n.)* FF052
urobilinogen *(n.)* FF053
Urochorda *(n.pl.)* CC128
Urochordata *(n.pl.)* CC127
urochrome *(n.)* FF051
urocoel *(n.)* FF015
Urodela *(n.pl.)* CC156
urogenital system *(n.)* FF025
uropygial gland *(n.)* CF095
uropygium *(n.)* CF110
uroscopy *(n.)* FF054
urostyle *(n.)* CK017
urticaria *(n.)* CF035
use *(v.t.)* AJ081
uterine *(adj.)* SE046
uterus *(n.)* SE035
utilize *(v.t.)* AQ023
utricle[1] *(n.)* (Bio) CT083
utricle[2] *(n.)* (Bio) HD054
utriculus *(n.)* HD051

vacate *(v.t.)* AA031
vacation *(n.)* AA008
vaccination *(n.)* JB052
vaccine *(n.)* JB049
vacuolar *(adj.)* CT056

vacuolated *(adj.)* CT057
vacuolation *(n.)* CT042
vacuole *(n.)* CT038
vacuolization *(n.)* CT041
vacuome *(n.)* CT039
vacuum *(n.)* KF012
vacuum distillation *(n.)* BB021
vacuum flask *(n.)* LB023
vacuum pump *(n.)* KF027
vagina[1] *(n.)*(Bio) CG259
vagina[2] *(n.)*(Bio) SE036
vaginal *(adj.)* SE047
vaginate *(adj.)* CG269
vagus nerve *(n.)* HB042
valence electron *(n.)* DC017
valence shell *(n.)* DC016
valency *(n.)* DC013
valency band *(n.)* NM052
valid *(adj.)* AM083
value *(n.)* AN037
valvate *(adj.)* CE175
valve[1] *(n.)*(Bio) CG202
valve[2] *(n.)*(Ph) NL013
van Allen radiation belts *(n.pl.)* NC047
van de Graaff generator *(n.)* QC020
van der Waals bond *(n.)* DA012
van der Waals equation *(n.)* EE016
vane *(n.)* CF082
vaporize[1] *(v.t.)*(Ch) EE048
vaporize[2] *(v.i.)*(Ch) EE049
vapour *(n.)* BC032
vapour density[1] *(n.)*(Ch) BA029
vapour density[2] *(n.)*(Ch) ED027
vapour pressure thermometer *(n.)* LA024
variable[1] *(n.)*(Bio, Ch, Ph) AN074
variable[2] *(adj.)*(Bio, Ch, Ph) AN101
variable capacitor *(n.)* QC037
variable resistor *(n.)* NJ031
variant *(n.)* TA018
variation[1] *(n.)*(Bio, Ch, Ph) AN047
variation[2] *(n.)*(Bio) TA015
variety *(n.)* CA005
variole *(n.)* CG289
vary[1] *(v.t.)*(Bio, Ch, Ph) AF073
vary[2] *(v.i.)*(Bio, Ch, Ph) AF082
vary[3] *(v.i.)*(Bio) TA036
varying *(adj.)* AN103
vascular *(adj.)* PA002
vascular bundle *(n.)* PB002
vascular cylinder *(n.)* CH058
vascular plant *(n.)* CH047
vascular plants *(n.pl.)* CB014
vascular ray *(n.)* PB040
vascular ring *(n.)* CH057
vascular system *(n.)* PA001
vascular tissue *(n.)* PB001
vas deferens *(n.)* SE021
vas efferens *(n.)* SE024
vasoconstriction *(n.)* FE031
vasoconstrictor *(n.)* FE034
vasodilation *(n.)* FE032
vasodilator *(n.)* FE035
vasomotion *(n.)* FE030
vasomotor nerve *(n.)* FE033
vasopressin *(n.)* JA032
v.d.W. *(abbr.)* DA013
vector[1] *(n.)*(Bio) JC014
vector[2] *(n.)*(Ph) EA007
veer *(v.i.)* FC049
vegetal pole *(n.)* SH096
vegetation *(n.)* GA010
vegetative *(adj.)* CH023
vegetative pole *(n.)* SH097
vegetative propagation *(n.)* GB058
vegetative reproduction *(n.)* SC064
vehicle *(n.)* EB029
vein[1] *(n.)*(Bio) PA013
vein[2] *(n.)*(Bio) PB010
vein[3] *(n.)*(Bio) CE081
velamen *(n.)* CS085
veliger *(n.)* SG053
velocity *(n.)* EA021
velocity modulation *(n.)* NC039
velocity ratio *(n.)* NA008
velum *(n.)* CG151
vena cava *(n.)* PA021
vena cava inferior *(n.)* PA026
vena cava superior *(n.)* PA028
venation *(n.)* CE083
venom *(n.)* MD006
venose *(adj.)* PA034
venous *(adj.)* PA033
venous system *(n.)* PA039
venter[1] *(n.)*(Bio) CJ037
venter[2] *(n.)*(Bio) FB038
ventilation *(n.)* JD006
ventilator *(n.)* JD007
ventral *(adj.)* CG011
ventral aorta *(n.)* PA018
ventral fin *(n.)* CF105
ventral fissure *(n.)* HB097
ventral horn *(n.)* HB093
ventricle[1] *(n.)*(Bio) PA047
ventricle[2] *(n.)*(Bio) HB084
Venturi meter *(n.)* EC085
Venturi throat *(n.)* EC084
Venturi tube *(n.)* EC083
venule *(n.)* PA014
verify *(v.t.)* AN116
vermiform *(adj.)* CG128
vermiform appendix *(n.)* MF049
vernalization *(n.)* GB048
vernation *(n.)* CE021
vernier scale *(n.)* EA005
vertebra *(n.)* CK018
vertebral *(adj.)* CK025
vertebral arch *(n.)* CK032
vertebral canal *(n.)* HB102
vertebral column *(n.)* CK011
vertebral foramen *(n.)* CK035
Vertebrata *(n.pl.)* CC130
vertebrate[1] *(n.)*(Bio) CK004
vertebrate[2] *(adj.)*(Bio) CK026
vertebrarterial canal *(n.)* CK023
vertical *(adj.)* AF091
very high frequency *(n.)* NC015
very low frequency *(n.)* NC023
vesicle *(n.)* CG285
vesicular *(adj.)* CG299
vesiculate *(adj.)* CG300
vesiculation *(n.)* CG286
vessel[1] *(n.)*(Bio) CG197
vessel[2] *(n.)*(Bio) PB036
vestibular canal *(n.)* HD069
vestibular membrane *(n.)* HD079
vestibule[1] *(n.)*(Bio) CG199
vestibule[2] *(n.)*(Bio) SE038

vestibule[3] *(n.)* (Bio) HD047
vestige *(n.)* CG338
vestigial *(adj.)* CG348
vexillum *(n.)* CF085
V.H.F. *(abbr.)* NC017
viability *(n.)* SA015
viable *(adj.)* SA019
vibrate *(v.)* AG050
vibratile *(adj.)* NB107
vibrating *(adj.)* NB104
vibrating air column *(n.)* NH081
vibrating string *(n.)* NH088
vibration *(n.)* NB089
vibrational[1] *(adj.)* (Ph) EA017
vibrational[2] *(adj.)* (Ph) NB106
vibration magnetometer *(n.)* QB020
vibrator *(n.)* NB090
vibratory *(adj.)* NB105
vibrio *(n.)* JC064
vibrissa *(n.)* CF045
vice versa *(adv.)* AM061
victim *(n.)* GA070
villus *(n.)* MF036
violent *(adj.)* AG109
viral *(adj.)* JC080
virile *(adj.)* SB068
virion *(n.)* JC068
virtual *(adj.)* ND071
virulence *(n.)* JC024
virulent *(adj.)* JC045
virus *(n.)* JC067
viscera *(n.pl.)* CJ033
visceral *(adj.)* CJ043
visceral mesoderm *(n.)* CJ012
visceral peripheral nervous system *(n.)* HB008
viscerocranium *(n.)* CK059
viscid *(adj.)* EC092
viscosity[1] *(n.)* (Ph) EC068
viscosity[2] *(n.)* (Ch) BA004
viscous[1] *(adj.)* (Ch) BA015
viscous[2] *(adj.)* (Ph) EC091
viscus *(n.)* CJ030
visible *(adj.)* HC018
visible spectrum *(n.)* ND096
vision *(n.)* HC002
visual *(adj.)* HC017
visual angle *(n.)* HC005
visual axis *(n.)* HC006
visual field *(n.)* HC004
visual plane *(n.)* HC007
visual purple *(n.)* HC095
visual yellow *(n.)* HC096
vital[1] *(adj.)* (Bio, Ch, Ph) AM039
vital[2] *(adj.)* (Bio) FA040
vital capacity *(n.)* MJ100
vitality *(n.)* FA005
vitamer *(n.)* MH039
vitamin *(n.)* MH038
vitamin A *(n.)* MH045
vitamin B_1 *(n.)* MH069
vitamin B_2 *(n.)* MH070
vitamin B_6 *(n.)* MH071
vitamin B_7 *(n.)* MH072
vitamin B_{12} *(n.)* MH073
vitamin B-complex *(n.)* MH060
vitamin C *(n.)* MH053
vitamin D *(n.)* MH050
vitamin D_2 *(n.)* MH051
vitamin D_3 *(n.)* MH052
vitamin deficiency *(n.)* MH058
vitamin E *(n.)* MH043
vitamin F *(n.)* MH055
vitamin H *(n.)* MH079
vitaminize *(v.t.)* MH059
vitamin K *(n.)* MH044
vitaminology *(n.)* MH057
vitazyme *(n.)* MH041
vitelline *(adj.)* SH112
vitelline blood vessels *(n.pl.)* SH081
vitelline membrane *(n.)* SH100
vitreous humour *(n.)* HC049
viviparous[1] *(adj.)* (Bio) SB088
viviparous[2] *(adj.)* (Bio) FA064
V.L.F. *(abbr.)* NC024
vocal *(adj.)* MJ114
vocal cord *(n.)* MJ109
void *(v.t.)* MG028
volatile *(adj.)* BC023
volt *(n.)* KG028
voltage *(n.)* NJ010
voltage amplifier *(n.)* NL032
voltameter *(n.)* EG018
voltmeter *(n.)* NJ091
volume *(n.)* AA024
volume dilatometer *(n.)* LA057
volumetric *(adj.)* BB062
volumetric analysis *(n.)* BB030
voluminous *(adj.)* AA037
voluntary action *(n.)* HB181
voluntary muscle *(n.)* CP034
vomer *(n.)* CK068
vomit[1] *(n.)* (Bio) MG014
vomit[2] *(v.i.)* (Bio) MG026
vomiting *(n.)* MG018
vulcanization *(n.)* BB124
vulva *(n.)* SE042

walk *(v.i.)* FC033
warm *(v.t.)* AD059
wastage *(n.)* JC134
waste product *(n.)* BB087
waste products *(n.pl.)* FE007
water *(n.)* DD022
water culture *(n.)* FH058
water equivalent *(n.)* LB033
water gas *(n.)* BB113
water-gas shift reaction *(n.)* BB107
waterlogged *(adj.)* FH079
water of crystallization *(n.)* BG009
water softening *(n.)* DD025
water table *(n.)* FH067
water vascular system *(n.)* CJ003
watt *(n.)* KG026
wattage *(n.)* NK107
wattless *(adj.)* NK123
wattmeter *(n.)* NJ100
wave *(n.)* NB001
waveband *(n.)* NC014
wave form *(n.)* NB005
wave front *(n.)* NB025
wave function *(n.)* NC088
wave group *(n.)* NB013
wavelength *(n.)* NB018
wave mechanics *(n.sing.)* NC086
wave motion *(n.)* NB002
wave number *(n.)* NB019
wave packet *(n.)* NB014

wave train *(n.)* NB012
wave velocity *(n.)* NB021
way *(n.)* AJ011
weak electrolyte *(n.)* EG021
wean *(v.t.)* SJ026
weathering *(n.)* FH038
web[1] *(n.)* (Bio, Ch, Ph) AC016
web[2] *(n.)* (Bio) CF011
weber *(n.)* KG034
weed[1] *(n.)* (Bio) GA141
weed[2] *(n.)* (Bio) GB049
Wehnelt cylinder *(n.)* NE037
weigh *(v.)* EB070
weight *(n.)* EB051
weightlessness *(n.)* EB053
weight thermometer *(n.)* LA059
wet *(v.t.)* ED046
wet and dry bulb hygrometer *(n.)* EE076
wetting agent *(n.)* DE006
Wheatstone bridge *(n.)* NJ075
wheel and axle *(n.)* NA016
whirl *(v.)* AF044
whisker *(n.)* CF044
white *(adj.)* AC038
white blood cell *(n.)* CR035
white fibro-cartilage *(n.)* CN035
white fibrous tissue *(n.)* CN002
white light *(n.)* ND109
white matter *(n.)* HB076
whole *(n.)* AE001
whorl[1] *(n.)* (Bio) SF015
whorl[2] *(n.)* (Bio) CK214
whorled *(adj.)* CE062
whorled phyllotaxis *(n.)* CE053
wild type *(n.)* TA017
will *(n.)* HB180
wilt *(v.i.)* CT093
winding *(n.)* NK095
wind instruments *(n.pl.)* NH078
wind-pipe *(n.)* MJ073
wing[1] *(n.)* (Bio) CF068
wing[2] *(n.)* (Ph) EC087
wing-petal *(n.)* SF043
wireless set *(n.)* NM005
wisdom teeth *(n.pl.)* ME062
withdraw *(v.t.)* AG144
wither *(v.i.)* FA034
withstand[1] *(v.t.)* (Bio, Ch, Ph) AD048
withstand[2] *(v.t.)* (Ph) EB037
Wolffian duct *(n.)* SE005
wolf note *(n.)* NH018
womb *(n.)* SE043
woody *(adj.)* CH025
woody perennial *(n.)* SD014
word class *(n.)* AK033
work *(n.)* NA001
work function *(n.)* NL075
working fluid *(n.)* NA034
worn *(adj.)* AG133
worn-out *(adj.)* AG134
wound *(n.)* JC083
wow *(n.)* NM021
wriggle *(v.i.)* FC019

xanthophore *(n.)* CT091
xanthophyll *(n.)* MC011
xero- *(pre.)* AL111
xeromorph *(n.)* GA138
xeromorphic *(adj.)* GA169
xerophilous *(adj.)* GA168
xerophthalmia *(n.)* HC054
xerophyte *(n.)* GA134
xerosere *(n.)* GA160
xiphisternum *(n.)* CK159
Xiphosura *(n.pl.)* CC094
X-ray diffraction *(n.)* BG018
X-rays *(n.pl.)* NE053
X-ray spectrometer *(n.)* NE058
X-ray spectrum *(n.)* NE059
X-ray tube *(n.)* NE054
xylem *(n.)* PB026
xylem vessel *(n.)* PB029

yawn *(v.i.)* ME013
yellow elastic tissue *(n.)* CN003
yellow fibro-cartilage *(n.)* CN033
yellow marrow *(n.)* CN057
yellow spot *(n.)* HC093
yield *(n.)* KA049
yield point *(n.)* KE010
yolk[1] *(n.)* (Bio) SH086
yolk[2] *(n.)* (Bio) SB079
yolk plug *(n.)* SH053
yolk sac *(n.)* SH079
yolk stalk *(n.)* SH080
yolky *(adj.)* SH114
Young's modulus *(n.)* KE014

Zener current *(n.)* NM079
Zener diode *(n.)* NM086
Zener effect *(n.)* NM077
zeolite *(n.)* NN008
zero[1] *(n.)* (Bio, Ch, Ph) AN009
zero[2] *(v.t.)* (Bio, Ch, Ph) AN014
zero coefficient of liquid expansion *(n.)* LA054
Zeroth law of thermodynamics *(n.)* LA002
zig-zag *(n.)* AG060
zinc point *(n.)* LA014
Zoantharia *(n.pl.)* CC015
zonal *(adj.)* CG175
zonary[1] *(adj.)* (Bio) CG177
zonary[2] *(adj.)* (Bio) SJ033
zonate *(adj.)* CG176
zone[1] *(n.)* (Bio, Ch, Ph) AA023
zone[2] *(v.t.)* (Bio, Ch, Ph) AA027
zooplankton *(n.)* GA183
zoosporangium *(n.)* SC031
zoospore *(n.)* SC020
zyg AL152
zygapophysis *(n.)* CK037
zygodont *(adj.)* ME112
zygogenetic *(adj.)* SB064
zygoma *(n.)* CK067
zygomatic arch *(n.)* CK066
zygomorphic *(adj.)* SF025
Zygomycetes *(n.pl.)* CB049
zygospore *(n.)* SC023
zygote[1] *(n.)* (Bio) SH001
zygote[2] *(n.)* (Bio) SH006
zygotene *(n.)* CU063
zymase *(n.)* MA042
zymin *(n.)* MA021
zymo-excitor *(n.)* MA060
zymogen *(n.)* MA053
zymogenesis *(n.)* MA055
zymogenic *(adj.)* MA058
zymolysis *(n.)* MA032

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